creative computing

May 1980
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How Safe is Your Computer?

Computer-Aided Model Rocket Design

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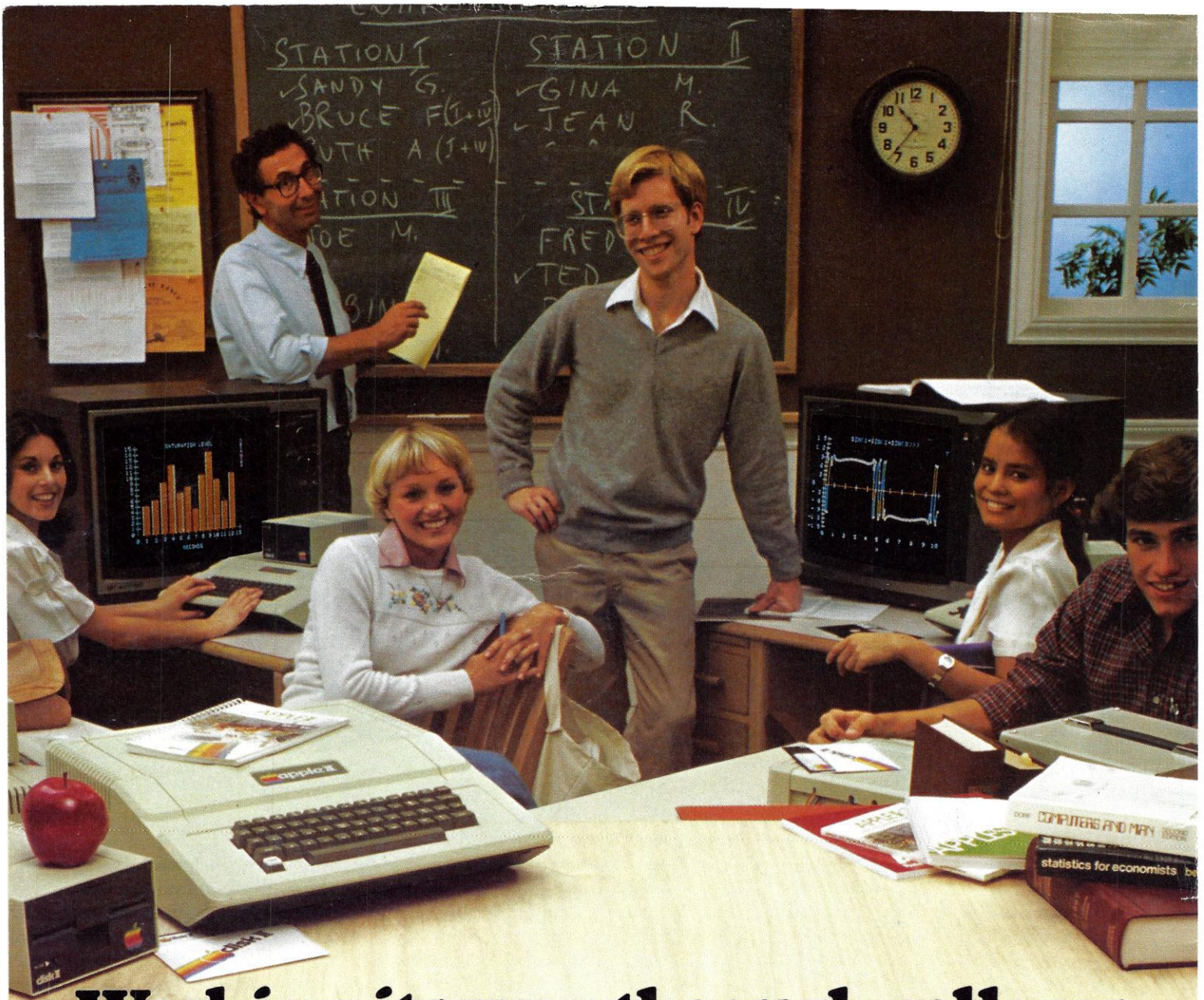
Evaluations and Reviews:
- APF Imagination Machine
- Universal Data Entry System
- Personal Software's Desktop/Plan
- Microsoft Adventure

Charles Babbage: A Look Back

Two Natural Language Systems

Columns:
- PET
- Apple
- TRS-80
- Reviews
- Intelligent Games
- Software Copyright



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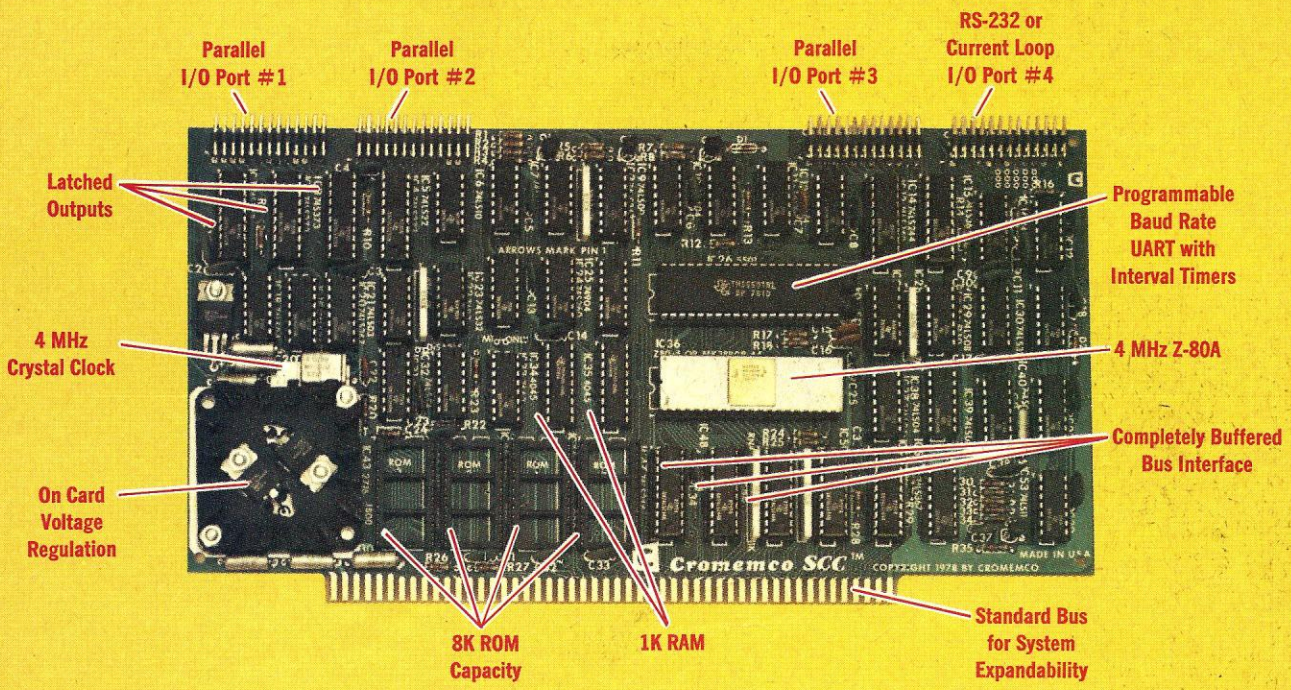

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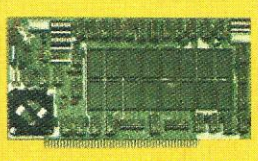

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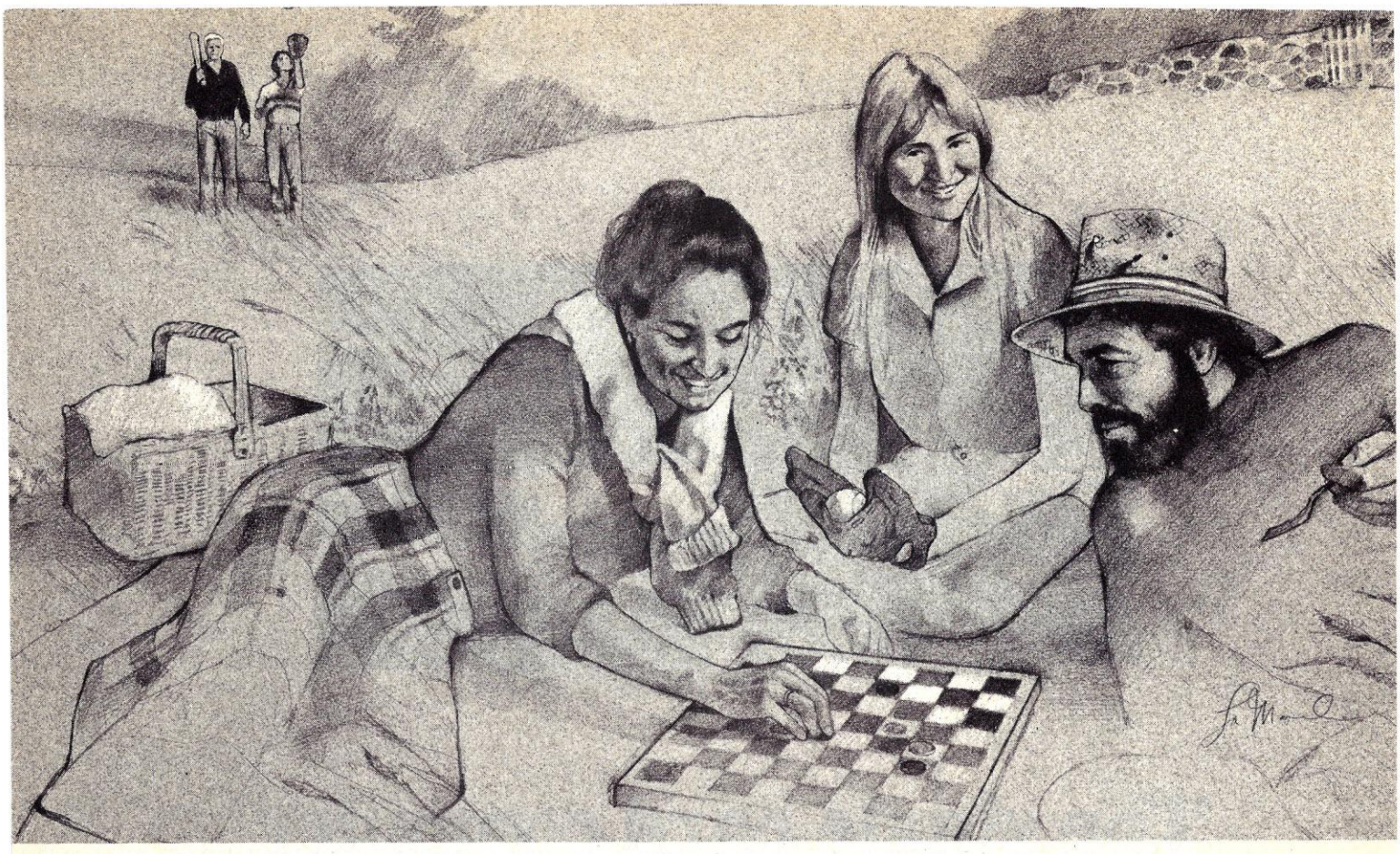

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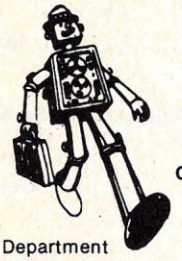
Editor **Ted Nelson**

Managing Editor **Burchenal Green**

Associate Editor **Steve North**

Contributing Editors **Frederick Chesson, Charles Carpenter, Margot Critchfield, Thomas W. Dwyer, Stephen B. Gray, Richard Kaapke, Stephen Kimmel, Harold Novick, Peter Payack, Alvin Toffler, C. Barry Townsend, Gregory Yob, Karl Zinn**



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Advertising Coordinator
Marcia Wood
Creative Computing
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BUDGET II *(not yet released) by Alan Meyers, takes off where CHECKBOOK II ends. Written exclusively for either disk or tape based computers, this program enables the user to set up 20 account names with four character codes for each, that correspond to the codes used in Checkbook II. Each account can be tagged income or expense and whether it is fixed or not. Set your monthly budget and balance it. Disperse your cash account over the other accounts. Checkbook II data is brought in and summarized by account and compared to amount budgeted. Year-to-date totals are included in monthly summary. Year Summary gives monthly and year totals for each account at a glance. Forecast feature enables user to enter rate of inflation and income increase to see financial standing after 12 months. Review enables user to go back and look at months previously summarized. Flashy graphics and much more. For 16K and 32K tape,* ***BUDGET II*** *sells for $24.50. For 32K up disk, $34.50. If you have CHECKBOOK II, you will want this program.*

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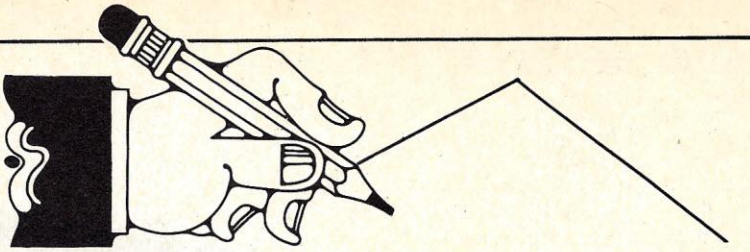

Humanity = Intelligence = Chauvinistic

Dear Editor:

Though not an expert in the computer field, I enjoyed your recent issue concerning Artificial Intelligence. Dr. Turing's article made fascinating reading and the articles by Doctors Dreyfus and Neisser brought up many interesting points.

Webster defines intelligence as "the ability to learn or understand or to deal with new or trying situations." Obviously, this ability is not an absolute: in the development of a brain (natural or artificial) there is some point below which intelligence cannot exist, but above that point intelligence exists on many levels. The point at which intelligence first occurs is very unclear, but recent work with animals indicates that at least many mammals and birds appear to be able to fulfill Webster's definition and are thought to possess at least a limited intelligence. This fact alone appears to negate Dr. Dreyfus' statement that "intelligence or the ability to reason cannot be separated from the rest of human life."

My limited knowledge of the human mind makes me agree completely with Dr. Neisser that machines do not now and probably never will carry out mental processes as do humans. I fail to see, however, how this fact eliminates the possibility of intelligence in machines any more than it eliminates some level of intelligence in the lower primates.

An interesting study might be to conduct Dr. Turing's "imitation game" with the roles reversed by making the interrogator and one subject a machine, and the other subject a man. If the machine interrogator was easily able to identify which subject was a man, would this prove the man to be unintelligent? Hardly. It would simply prove that the man was not adequately machinoid.

Although artificial intelligence researchers who attempt to make machines humanoid may be pursuing an elusive (perhaps impossible) goal, their critics who equate humanity with intelligence are taking a very chauvinistic viewpoint. Just as it is an error to create God in man's image, it is also a mistake to create intelligence in man's image.

I appreciate your excellent magazine and look forward to receiving the next issue.

Kenneth L. Farrimond, M.D.
914 Oak Hills Medical Building
San Antonio, TX 78229

Help With Stock Monitor

Dear Editor:

I liked the program in the February '80 issue, "Stock Monitor" beginning on page 56. There were three errors:

Line 80 extra comma after **160**
Line 176 need comma in blank space after **A(L)**
Line 194 extra comma after **B$**

The missing comma in 176 took me and Fred, a programmer at Union Pacific, over an hour to figure out.

The article, although interesting, failed to describe the program and it's variables.

Thank you for a fine magazine.

Richard Swig
104A Jennings Rd.
Council Bluffs, IA 51501

Master Disk Directory in Basic

Dear Editor:

In reference to your article "A Master Disk Directory" in the February 1980 issue:

It would seem my progress along similar programming paths has paralleled his. However, I have been able to do the same task **without having to leave Basic** as he points out is required. All that is required is a simple object code routine (written in free RAM scratchpad area) which can be included in the Basic program. The following data illustrates:

```
110 REM*****************************************************
113 REM* READ DISK DIRECTORY ROUTINE
116 REM* G.A. SMITH  1/18/80
119 REM* INSERT THIS CODE BETWEEN LINES 100 AND 180
122 REM*****************************************************
125 Z=51456\REM <<ROUTINE TO BE LOCATED AT C900(H)>>
128 FOR Z1=1 TO 16
131 READ Z2
134 FILL Z,Z2
137 Z=Z+1
140 NEXT Z1
143 REM <<Since object code routine must be in DECIMAL>>
146 REM <<The decimal number 156 equates to hex '9C' or >>
149 REM <<9*16+12 thus we are locating directory data   >>
152 REM <<at location 9C00 Hex                          >>
155 GOTO 161
158 DATA 62,04,06,01,14,01,17,0,156,33,0,0,205,34,32,201
161 REM >> NOW CALL THE SUBROUTINE WRITTEN BY THE ABOVE <<
164 REM
167 !CHR$(11)\!\!"READ DIRECTORY DATA INTO RAM AREA"\!
170 INPUT"PLACE DESIRED DISK INTO DRIVE; HIT C/R: ",Z$
173 X2=CALL(51456)
NORTH*STAR BASIC 6.5 RELEASE 4  READY...
```

This type of approach to directory management, using Basic CALLS to existing DOS routines, makes the task much easier and eliminates the chance of accidentally crashing the system through inadvertent entry to Basic at wrong address, etc.

Also.....the task of building the Master File moves along much faster!!

Gregori A. Smith
2845 Westberry Drive
San Jose, CA 95132

Applause For The Good Guys

Dear Editor:

I believe that when companies give extra service to their customers they need to be commended for it. I am writing to make such a commendation about a company: C & H Micro. I believe my association with this company should be told to your readers. (Don't your readers deserve to know about super companies who will make their mail order buying a pleasure?)

I purchased C & H Micro's Textpage. I had some difficulty with it and I wrote to them expecting to get a letter in return. Much to my surprise they called me long distance to tell me what changes to make in the program. Also, they followed up the telephone call with further information and documentation.

Do you agree that this company has a refreshing attitude? I will certainly continue to do business with them and I hope with this recommendation your readers will do the same.

Robert B. Reese, D.D.S.
9104 Spring Lake Drive
Austin, TX 78750

[ED. NOTE: C & H Micro's address is P.O. Box 249, Clifton Park, NY 12065] **CIRCLE 305 ON READER SERVICE CARD**

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I/O, cont'd...

Still Flipping Frenchman

Dear Editor: N. B. Winkless, Jr. has a good procedure for his probability argument in "Two million Frantic Frenchmen: A study in probability" (June 1979). He calculated the first few cases for the probability p(2n) that flipping 2n coins will give exactly n heads, and concluded that $\frac{p(2n+2)}{p(2n)} = \frac{2n+1}{2n+2}$

He was right, as can be seen by using binomial coeffieients $C(n,k) = \frac{n!}{k!(n-k)!}$

Namely, of the 2n flips, there are C(2n,n) ways to get n heads out of 2^n possibilities.

So $p(2n) = \frac{C(2n,n)}{2^{2n}} = \frac{(2n)!}{(n!)^2\ 2^{2n}}$

Then the Winkless result follows quickly:

$$\frac{p(2n+2)}{p(2n)} = \frac{(2n+1)(2n+2)}{(n+1)^2\ 2^2} = \frac{2n+1}{2n+2}$$

Before using our calculator mode to check his calculations, though, let's first note the approximation for large values of n : $p(2n) \approx 1/\sqrt{\pi n}$, which follows from the description of p(2n) above and Stirling's approximation for factorials.

Now, let the game begin! Ten years (i.e., 3.156×10^8 seconds) later, we expect to find $p(3.156 \times 10^8) \times 2$ million $\approx$ 63.52 Frenchmen left in the game. This is the statement attributed to Borel that after ten years there would still be about a **hundred** (not **thousand**) still flipping Frenchmen.

And finally, if the game ran for 1000 years (i.e., 3.156×10^{10} seconds), then we should expect to find $p(3.156 \times 10^{10}) \times 2$ million $\approx$ 6.35 (i.e., about ten) Frenchmen still at work. I'll leave it an exercise to verify H. R. Hollander's calculations (subsequent letter to **Creative**) by using the approximation $p(2n) \approx 1/\sqrt{\pi n}$.

Peter R. Atwood
Mathematics Department
Grand Rapids Baptist College
Grand Rapids, MI 49505

PS—Hollander's request for information on Borel is more difficult. I suspect that it was not a 17th century Edmund Borel, but the 20th century Emile Borel (1871-1956) that was intended. Emile Borel was a preacher's kid who had a kdeep interest in mathematical analysis and probability, and was a mathematics professor most of his life. A biographical sketch is given in Grove & Ladas, "Introduction to Complex Variables," page 47 (Houghton-Mifflin: 1974).

More on GENE

Dear Editor:

I enjoyed reading GENE: Retracing Your Past Through Genealogy in the February '80 issue. I found a simple way of maintaining birthdays with the following two changes:

(new) 1415 G = LEN(R$)

(rev) 1420 IF LEFT$(N$(J),G) = R$ THEN 1460

The birthdays can then be carried after the names and at no extra increase of dimensioned arrays. The small problem of the top line no longer being symmetric is a small price to pay.

Peter R. Ohs
4605 Westridge Place
Camp Springs, MD 20031

A Note on Labanotation

Dear Editor:

I have been watching for readers' comments on your article on computers and dance (Aug 1979). Since none have appeared, maybe I can encourage some comment.

As both a long time amateur notator (Labanotation) and computer professional, one of my first experiments with my Level I, 4K TRS-80 was keyboard entry to generate notation on the screen. It was more successful than I had expected and an interesting project in the limited TRS-80 graphics. (Labanotation is read from bottom to top, with 10 to 20 possible columns of symbols per staff.)

Although the project was a potentially useful one, I ran out of memory, and was not happy with the time required to enter the data. By the time I got more memory, I had several other exciting projects for the TRS-80 so I have done very little other than convert the program to Level II and light pen input.

The problems for which the computer could be a great help are:

- editing existing computer readable scores—add, change, delete
- editing for reasonableness—you can't take two successive steps on the same foot except as a hop
- generating printout of (nearly) publishable quality
- style analysis.

New symbols are being added to the system as we find better ways to deal with the complexities of recording movement.

I would like to hear from anyone who is working on, or interested in, movement notation on personal computers.

There is another computer-Labanotation project at the University of Iowa which Ms. Hirschmann may not have been aware of.

Dawn A. Smith
Box 115 Turnpike Sta.
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I/O, cont'd...

Clear Basic

Dear Editor:

The article by David E. Powers (Feb.'80) on the FMG Pascal for the TRS-80 was an informative and helpful overview of Pascal, but it failed to give proper credit to the potential for "clean" programming with TRS-80 Basic. His Basic version of the FACTROOT program, meant to parallel the Pascal version, had the usual coding *faux pas* that make a program difficult to read in any language, i.e., multiple statements per line, gratuitous branching and lack of documentation. Herewith is a rewritten version of FACTROOT that attempts to take full advantage of the styling available in the Microsoft Basic implemented on the TRS-80: Ample use of remarks (using the apostrophe, which is less distracting than REM), mnemonic variable names, and indentation of loops and related subroutines.

The rewritten program also corrects a couple of errors in Powers's original version. TRS-80 Basic cannot distinguish between his variables, LOWLIMIT and LOOPCOUNT, since it keys on the first two characters in the name. This was corrected by calling the former LWLIMIT, which still retains the mnemonics. In his output (line 140) LOWLIMIT should be LOOPCOUNT. Also, in his routine for square roots (lines 1010 and 1020), RESULT should be LOOPCOUNT. These have also been corrected in my revision.

I'm not trying to defend Basic, *per se*, so much as urging the proper use of what we have available. Basic need not produce muddy, mysterious pieces of code. Admittedly, "proper" coding takes more memory—my code takes about 1400 bytes vs 700 for Powers's—but isn't it worth it to be able to read it intelligibly months later?

Donald B. Heckenlively, Ph.D
Department of Biology
Hillsdale College
Hillsdale, MI 49242

```
100 '*****************************************
110 ' PROGRAM FOR FACTORIALS AND SQUARE ROOTS
120 ' BASED ON PROGRAM BY D. E. POWERS IN
125 ' CREATIVE COMPUTING MAGAZINE, FEB., 1980
130 'REVISION BY D. B. HECKENLIVELY
135 '           HILLSDALE COLLEGE
140 'AIM:  TO SHOW THAT BASIC NEED NOT BE
145 '      UNREADABLE AND CAN ALMOST BE PRETTY
150 '*****************************************
160 '
170 'DEFINE VARIABLES
175 '
180 DEFINT H,L,I
190 EPSI = 1E-5
200 P1$ = "##########   "
210 P2$ = "##.######^^^^  "
220 '
230 '  INTRODUCTION AND INPUT OF LIMITS
235 '
240 CLS: PRINT,"FACTORIAL AND ROOT COMPUTATION"
250 INPUT "ENTER LOW LIMIT (0 < LOW < 21)  ==> ";LOWLIMIT$
260     LWLIMIT = VAL(LOWLIMIT$)
270     IF LWLIMIT < 1 OR LWLIMIT > 20 THEN 250
280 INPUT "ENTER HIGH LIMIT (1 < HIGH < 21)  ==> ";HIGHLIMIT$
290     HILIMIT = VAL(HIGHLIMIT$)
300     IF HILIMIT < 1 OR HILIMIT > 20 THEN 280
310 '
320 '  FACTORIALS AND SQUARE ROOTS
325 '
330 '  (HEADINGS FIRST:)
340 PRINT "    NUMBER","FACTORIAL","SQUARE ROOT"
350 FOR LOOPCOUNT = LWLIMIT TO HILIMIT
360 '  (FACTORIAL:)
370     RESULT = 1
380     FOR I = LOOPCOUNT TO 1 STEP -1
390         RESULT = RESULT * I
400     NEXT I
410 '  (SQUARE ROOT:)
420     ROOT = 1
430     ROOT = (ROOT + LOOPCOUNT/ROOT)/2
440     IF ABS(LOOPCOUNT/(ROOT^2)-1) > EPSI THEN 430
450 '  (PRINT RESULTS OF COMPUTATIONS:)
460     PRINT USING P1$; LOOPCOUNT,
470     PRINT USING P2$; RESULT,ROOT
480 NEXT LOOPCOUNT
999 END
```

et cetera

DEC Opens Digital Computer Museum

The Digital Equipment Corporation (DEC) opened the Digital Computer Museum in September, 1979, for use by DEC personnel and their customers. The museum occupies the lobby and mezzanine of DEC's Tower Building in Marlboro, Massachusetts. It will be open to the public in May, 1980.

At this time the museum contains: various posters and computer family trees which outline the growth of computing devices; parts from MIT's Whirlwind computer; the complete TX-O from Lincoln Laboratory; an extensive calculator exhibit showing the progression from the abacus to the electronic calculator and including "Napier's bones"; an exhibit showing four generations of logic; a primary memory exhibit with nearly all technologies; a PDP-1 and PDP-8, both operational; and the LINC-based Laboratory Computers—LINC, LINC-8, PDP-12, and MINC. A CRT, connected to a local VAX-11, is utilized as the exhibit guide/directory to the museum. About half of the museum is comprised of non-DEC parts, and this balance is intended.

As the museum evolves it will acknowledge a variety of audiences, but for now it is oriented to those with computer backgrounds. The exhibitions will include not only displays in cases, but viewer-operated, audio-visual presentations and interactive exhibits and slide presentations on logic/memory evolution. Also planned is a gallery of parts and manuals from DEC machines and an exhibit showing the evolution of secondary memory.

Call for Papers

The Thirteenth Annual ASCUE Conference will be held at the University of Tennessee at Martin, June 16-19. Papers to be given by members should be sent to the conference director: James Westmoreland, University of Tennessee at Martin, Martin, TN 38238. Jim's phone number is: 901-587-7891. Some topics in which members have expressed interest are: Structured Programming, Database Management Systems, Programming in Pascal, Applications of Microcomputers and Computer Graphics. Other topics, of course, are always acceptable.

Computer Power

A curriculum development project for high school computer science for the 1980's is being developed by the National Science Foundation and the University of Tennessee. The curriculum is based on color graphics on microcomputers, uses the Pascal language, and is designed for the general audience rather than "science-track" students. The basic idea is to use graphics, rather than numbers, as the fundamental "product" of computing.

Twelve test schools in the Southeast will be chosen to use the curriculum in 1981. National distribution will begin in Spring, 1980. A school can be one of the twelve test schools if it is within 400 miles of Knoxville, Tennessee; it has, or will acquire, one or more microcomputers of a type compatible with the software being used by the project; one of its teachers can attend a one-week workshop in Knoxville during the summer of 1981 (expenses paid by NSF).

It is not necessary that a school have been teaching computing prior to 1981; we want some schools that have and some that haven't. For further information, contact:

Michael Moshell, Director
High School Computer Science Project
Computer Science Department
University of Tennessee
Knoxville, TN 37916
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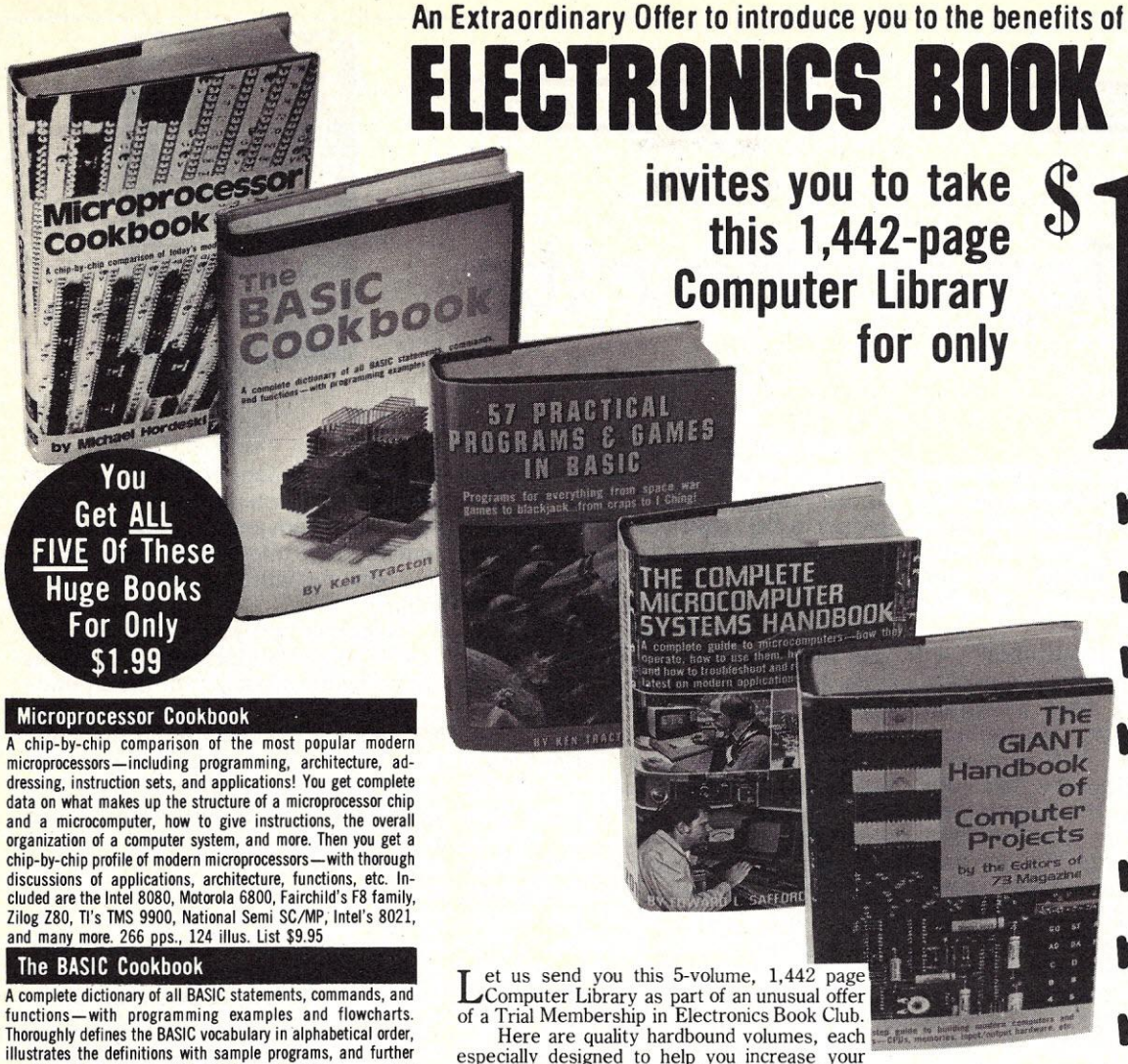
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Effective Writing

Carl E. Whitney

The Joy of Rewrite

Writing crisp, communicative prose is hard work. It involves getting something on paper, looking at it from the reader's point of view, finding the rough sports, and correcting them. The secret of good writing is rewriting.

But what is a "rough spot"? It's anything that will confuse, obstruct, or bore the reader. It's a paragraph with no coherence, a sentence without simplicity. It's a line of excess verbiage, a phrase that communicates nothing. It's a grammatical blunder, or a pronoun with uncertain antecedent. It's an awkward phrasing. It's a careless parenthetical remark that interrupts the smooth flow of thought.

The unfailing antidote to the rough spot is "the ear." "The question of ear is vital," says E. B. White in **The Elements of Style.**' "Develop your ear!" say Marie L. Waddell and her co-authors in **The Art of Styling Sentences**, a useful though unexciting manual. Develop your ear! One imagines an exotic cult paying reverence to a huge papier-mache ear...earlobe fetishists...inner ear partisans...anvil liberationists...

A sense of gracefulness and efficiency is indeed valuable to the writer, and he or she can cultivate it by reading good literature. But logic plays an important part in discovering and correcting rough spots; we'll explore this more fully in future columns. Right now, the subject is more fundamental than style; it is thinking—and motivation. For much of the rewriter's art is simple willingness: willingness to apply logic, willingness to undertake the laborious, often frustrating chore of turning out clean prose. We can admire the effortless, translucent quality of E. B. White's writing, and despair at the clumsy, amateurish tinge of our own. But we're forgetting something. More likely than not, White wrote three or four drafts. We write only one.

And our ideas don't flow smoothly in that first draft. They have rough spots; they don't appear in the proper order, appropriately stressed and smoothly linked. Before the ear can consider matters of style, the mind must grapple with questions of content. However carefully we plan, and whatever we write—novel, magazine article, operating manual—we'll have to polish up our ideas during rewrite.

For example, your fearless correspondent recently wrote an article for this magazine; the subject was the effect of inflation on retired people. The first draft began: "Despite today's historically high interest rates, the 'real' return on many investments is still negative." This was meant to hook the reader's interest by mentioning a current news item. But the article was about retired people's money, not interest rates; I was misleading the reader. Furthermore, I used the technical term "real return" to abruptly; unsophisticated readers would be confused by this term. (It means the inflatin-adjusted, after-tax return on an investment.)

So I asked myself the always-useful question, "What is it you really want to say?" And what I wanted to say was: "Inflation puts many retired people in a difficult position." This was simpler, cleaner, and more logical. It rang true.

Clear thinking, then, is a prerequisite of good writing. Substance precedes form; the flow of thought dictates the optimum structure of paragraphs and sentences. After you've formed a clear picture of your message, then you'll have a logical framework for the host of minor stylistic decisions you must make.

(Regarding overall structure, the manuals say: "Choose a suitable design, and hold to it." This won't always work. Ideas are protean; they look different on paper than in the mind. Facts, too, can be uncooperative. In many cases, the design itself will prove inadequate after the first draft is completed; better to resign yourself in advance to an extensive rewrite. You might also think about text editing/word processing capability.)

Suppose that you're one of those well-financed purists who regard the TRS-80 with disdain. "In the opinion of this writer," you begin, "the TRS-80 is a basically good machine, though it has some hardware problems. The Pet, on the other hand, is a well-designed machine with a somewhat less powerful Basic." This is typical first-draft stuff—wordy, mushy, and ugly; a kind of verbal smog. So start pruning. First, it's rarely necessary to point out that something you write is your opinion. The reader already knows that. Strike "in the opinion of..." Next, strike the word "basically." Always strike the word "basically," and cast a suspicious eye on "somewhat."

Now, think about what you want to say. You have three utterly vague expressions: "good machine," "some hardware problems," and "well-designed machine." What exactly do you mean? What is it you really want to say? How would you say it in conversation? **You mean that the TRS-80 has a dynamite Basic but why did they have to put in all those tacky cables?** The Pet's problem, you've decided, is mostly one of image.

Now you have it. "The TRS-80 is flimsy but powerful; the Pet is reliable but unglamorous." By rethinking your message, and using a powerful trick called "parallel construction," you've summarized your opinions in an intriguing contrast. If you're writing a formal report instead of a magazine article, and aren't so worried about the reader's wandering attention, then you'll do it a little differently. But the principle is the same. Think about your message, and build a structure to fit it.

Next: awkwardness. □

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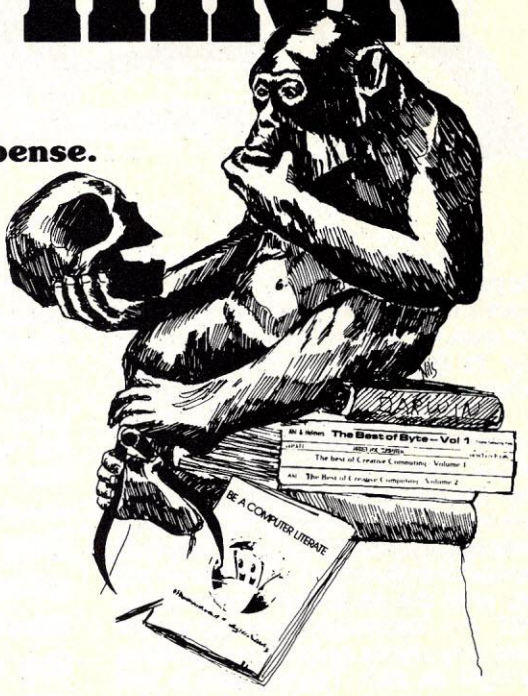

Strategy Games - 1 keeps games players in suspense.

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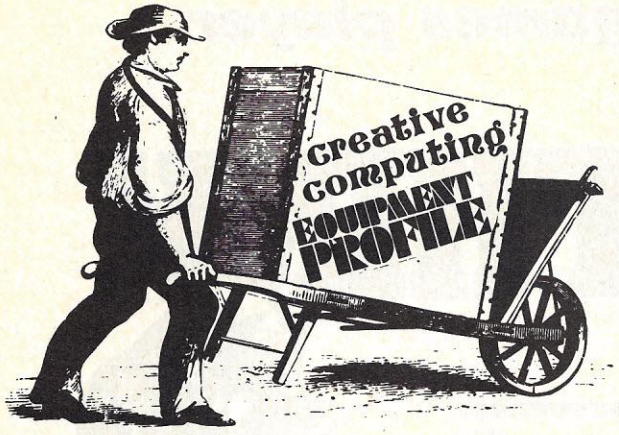

A Printer For Your PET — From Commodore?

A critical look at the Model 2022

Larry Watkins

I had given up hope months ago of Commodore ever being able to produce a PET printer. It was very difficult through those long printless months not to give up and order another printer and forego the PET graphics.

After waiting so long, I had several proconceived ideas about what the printer should do. I was right on only two counts. It is a dox-matrix impact printer, and it does print on paper. The print quality is excellent except for two design shortcomings. The printer will not print the same 8x8 matrix as the PET, but instead prints a 7x6 matrix. This only shows up in inverse printing or light on dark. The problem is that portions of some characters print at the edge and are difficult to read. The top of a T, for example, blends into the spaces between the lines and makes for hard reading. Another problem is the limitation of five lines of print in reverse field. The caution from the users manual is as follows: "Extended use of this mode of printing is not recommended since damage will occur to the print head if more than five consecutive lines are printed." This causes some severe limitations for certain graphics applications.

The 2022 is very noisy, in fact almost as noisy as a Model 33 Teletype. My system is in the utility room, and once, when the kids were using it, I mistook the sound of the printer for the washing machine. The entire inside of the cover is lined with a sponge foam material, but it doesn't quiet it very much. I have to shut the printer off when the phone rings in order to carry on a conversation.

Another complaint concerns two screws which hold the cover down. If they're removed, which is necessary to insert paper, the cover has no latch until you put the screws back. A further problem with the cover is that you must tilt the tractor assembly forward to raise or lower it. This is a minor mechanical engineering problem that shouldn't exist in a production machine.

Documentation is better than usual for Commodore, even though the manual I received was a preliminary version. I sent in the card to get the final release when it becomes available, but I wonder if I'll have to pay for it as I did my PET user's manual. The only documentation lacking is in the mechanical area. The mechanical illustrations are of poor quality and difficult to understand. I believe all factory documentation should include a full set of parts numbers and adequate mechanical illustrations to complement the programming parts of the Manual.

Once, when the kids were using it, I mistook the sound of the printer for the washing machine.

Physically, the printer is very sound, and construction is of good quality. The only thing I've found that doesn't work at all is the rod for holding the cover open while you change your paper. It is too big and is going to require some filing to fit.

At $995, plus the cable, the printer seems overpriced. I suspect that if someone else had produced a PET-compatible printer, the price would have been more reasonable. Since no one has, the price will probably stand. But I'd buy the 2022 again if I had it to do over, and I guess that's the best indication that it's doing the job for me.

Larry Watkins, Rt. #1, Box 143, Nixa, MO 65714.

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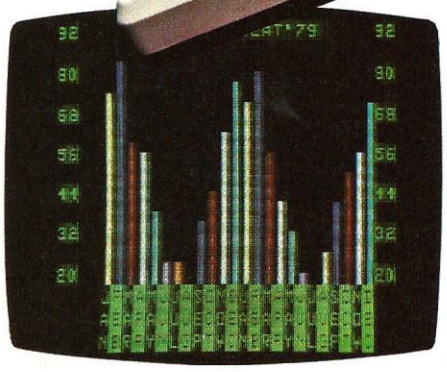

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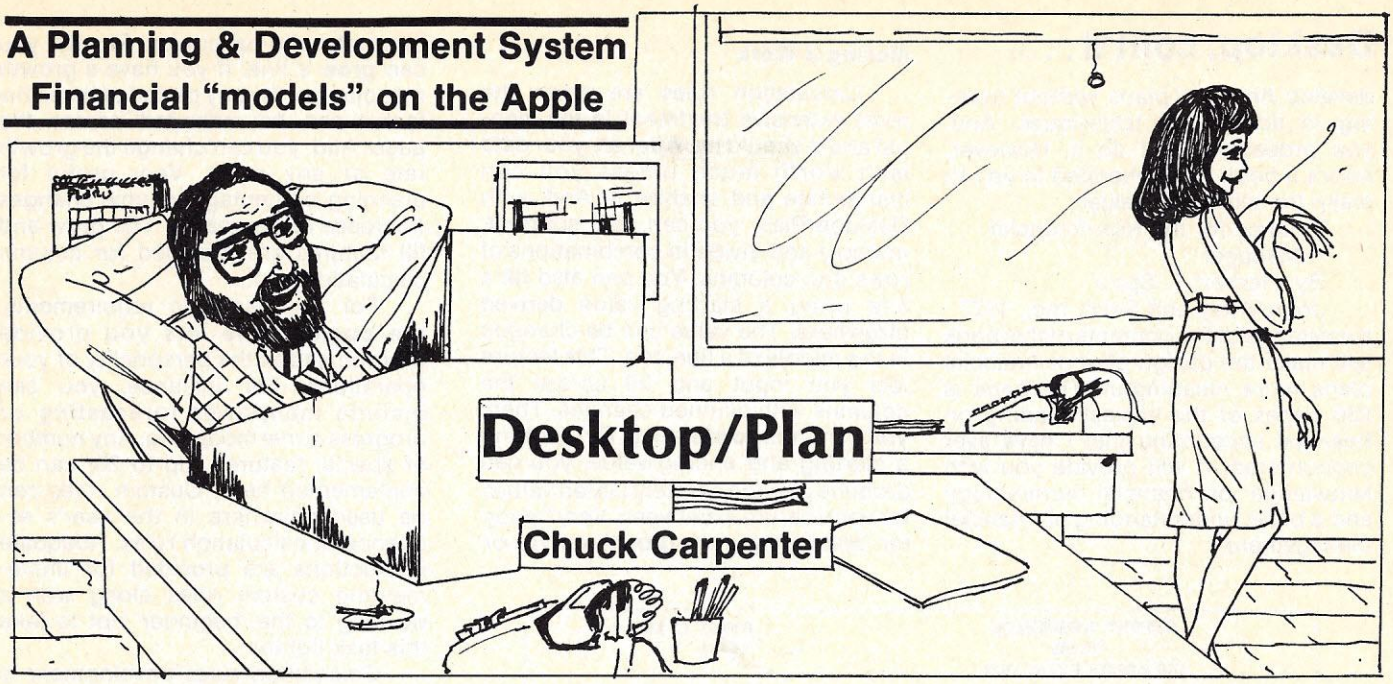
A Planning & Development System
Financial "models" on the Apple



Desktop/Plan is a flexible, business planning and development system. Its purpose is to assist managers and planners with the development and operation of financial "models" of business systems. The planning system is designed for execution in "desktop computers": specifically, the Apple II with DOS and a printer. Desktop/Plan provides computer assistance in performing the four major functions of financial modeling:

- Developing the model
- Executing the model
- Modifying the model
- Presenting the results

This planning system will be useful to managers and planners in businesses of all sizes. The small business manager would plan the data base model then use it to predict and measure performance. The large-company executive could use it as an adjunct to the main computer system. Any manager would have complete visibility and the flexibility to manipulate and monitor the activity of the business on a real time basis.

Desktop/Plan has many good features. It is a very comprehensive and detailed planning system. The amount of work put into the design and the practicality of the results, is a tribute to the skill of its developer, Don Williams.

Documentation

Documentation included in the manual is extensive, comprehensive and detailed. The documentation is a refreshing change from the present norm in products for personal, desktop computers. There are many good illustrations and the examples are clear. Descriptions are kept short and to the point. Additionally, there is plenty of space for user notes and comments. Nothing is crammed in or squeezed together. There are several typos and errors of omission — typical of many newly published documents. But they do not create confusion or reduce readability of the manual.

Getting Started

Introduction to the system is characteristic of the depth of coverage in the manual. The user is provided with descriptions and explanations of financial modeling, some good points on single-job applications and the significance of using desktop computers for the protection of your private data.

Other topics introduced include how to use the manual, some facts on the application of planning systems in small computers (Apple) and mainframe systems and a system overview. The system overview provides the user with a summary of each of the system options and describes various menu options and operating features. Figure 1 is a listing of the Desktop/Plan main menu. Sub-menus under each main topic further divide the selection and function capability.

Reports

Although not the first selection on the menu, reports are described first. And this is a good choice. Because the Reports function is used as a development tool, this section provides the user with needed support documentation. Instructions provided help you generate a customized blank report format. This blank format will be used to develop your unique simulation model. In this way you can build and/or modify the model according to the actual work sheet you will use (see Figure 2).

```
DESKTOP/PLAN
JULY 24, 1979
1. DESIGN A MODEL
2. MODIFY A MODEL
3. EXECXUTE MODEL CALCULATIONS
4. DISPLAY MODEL VALUES
5. PRINT MODEL REPORTS
6. CONSOLIDATE MODEL VALUES
7. COPY MODEL FILE TO BACKUP DISKETTE
0. RETURN TO OPERATING SYSTEM
 ...SELECT FUNCTION DESIRED:
                          .
                          1
DEVELOP A MODEL

1. CREATE A REPORT SPECIFICATION FILE
2. CREATE A PLANNING VALUES FILE
3. CREATE A CALCULATION RULES FILE
4. RETURN TO MAIN MENU
 ...SELECT FUNCTION DESIRED:
                          .
                          3
```

Main menu and a sub-menu selection.

The contents and options of Reports are described along with definitions for designing a report, entering report specifications and printing the report. The sections on generating the Report are concluded with a discussion on developing and entering values. Throughout, there are illustrations, diagrams and detailed dialogue to show and tell you how to do it.

Helpful Assistance

In the introduction to Desktop/Plan it is mentioned that a user could

Chuck Carpenter, 2228 Montclair Pl., Carrollton, TX 75006.

Desktop, cont'd . . .

develop financial plans without training in accounting techniques. And, you probably could do it. However, here's a book recommended to you to make the job much easier:

Finance for the Non-financial Manager
By: Herbert T. Spiro
John Wiley and Sons, Inc., 1977

Knowledge of the contents of this book will make the design of your financial plans more meaningful. The book is 230 pages of the easiest reading on financial accounting that I have ever encountered. It will provide you with knowledge of financial terminology and a basic understanding of financial management.

Making it Work

Calculation rules are given the most extensive treatment in the manual and it should be. After all, your data isn't worth much unless you can manipulate and analyze it. And, with Desktop/Plan, you can add, subtract, multiply and divide in combinations of rows and columns. You can also **fill** a line using a starting value derived elsewhere. The value can be changed in the middle of a line, too. This feature lets you input and fill across the columns with planned changes. Then, you can **interpolate** a line. By inputting a starting and ending value, you can produce a range of interpolated values for each period in between. Very handy for developing cash growth curves or product build-up curves. Finally, you can **grow** a line. If you have a growth rate planned for any period of time, this factor can be extended across the page. And, you can change the growth rate at any point. Very useful for planning percentage volume changes (increase or decrease). The grow and fill features are provided for column calculations, too.

For your specific requirements, the **custom rule** lets you provide programs to fit the personality of your operations. For instance, you can include manpower forecasting or progress curve modelling. Any number of special features (up to 20) can be implemented here. Custom rules can be used anywhere in the user's sequence of calculation rules. Adequate instructions are provided for implementing custom rules along with a warning to the 'beginner' not to take this task lightly.

Calculation rules development is described by illustrations throughout and a sample work-sheet is provided. More illustrations and examples are provided for entering and executing calculation rules. Figure 3 is a summary listing of Desktop/Plan calculation rules.

COMPUTER IMAGINEERING
DALLAS
1ST QUARTER-FISCAL 1979

AUGUST 7, 1979
PAGE 1

VALUES ONLY	JANUARY	FEBRUARY	MARCH	QTR TOTAL
GROSS SALES	235000.00	230000.00	237000.00	-
LESS RETURNS & ALLOWANCES	7525	6500	7000	-
NET SALES	-	-	-	-
COST OF GOODS SOLD	130000	122000	125000	-
GROSS PROFIT	-	-	-	-
OPERATING EXPENSES				
SELLING	52000	51000	54000	-
GENERAL	23500	22000	23000	-
ADMINISTRATIVE	11000	11500	11200	-
DEPRECIATION	850	800	825	-
OPERATING INCOME	-	-	-	-
OTHER INCOME	7500	2000	20000	-
NET INCOME BEFORE TAXES	-	-	-	-
ESTIMATED INCOME TAXES	9165	9464	18707	-
NET INCOME	-	-	-	-

Example of Desktop/Plan reports.

CALCULATED VALUES	JANUARY	FEBRUARY	MARCH	QTR TOTAL
GROSS SALES	235000.00	230000.00	237000.00	702000.00
LESS RETURNS & ALLOWANCES	7525	6500	7000	21025
NET SALES	227475	223500	230000	680975
COST OF GOODS SOLD	130000	122000	125000	377000
GROSS PROFIT	97475	101500	105000	303975
OPERATING EXPENSES				
SELLING	52000	51000	54000	157000
GENERAL	23500	22000	23000	68500
ADMINISTRATIVE	11000	11500	11200	33700
DEPRECIATION	850	800	825	2475
OPERATING INCOME	10125	16200	15975	42300
OTHER INCOME	7500	2000	20000	29500
NET INCOME BEFORE TAXES	17625	18200	35975	71800
ESTIMATED INCOME TAXES	9165	9464	18707	37336
NET INCOME	8460	8736	17268	34464

PREPARED WITH DESKTOP/PLAN--COMPANY CONFIDENTIAL

Example of a report generated with Desktop/Plan at The Computer Imagineering Store. Paul Dishman, owner of Computer Imagineering, has used Plan on the Polymorphics system. Paul indicates that Plan for the Apple II is a much expanded system. Note that top part is data before calculations and bottom section shows values after calculations.

```
ENTER CALCULATION RULES

1-ADD 2 LINES          10-ADD 2 COLUMNS
2-ADD GROUP LINES      11-ADD GROUP COLS
3-SUBTRACT LINE        12-SUBTRACT COLS
4-MULTIPLY LINE        13-MULTIPLY COLS
5-DIVIDE LINE          14-DIVIDE COLS
6-ACCUMULATE LINES     15-COMPUTE G/R
7-EXTEND/FILL LINES    16-FILL A COLUMN
8-INTERPOLATE LINES    17-USE CUSTOM RULE
9-GROW A LINE          18-'NULL' RULE

TYPE 'END' TO QUIT ENTERING RULES
NUMBER FOR FUNCTION DESIRED:...
```

Listing of calculation options.

More Features

Other options include the ability to build sub-models, make changes to models and sub-models and print reports. Sub-models are useful for building the overall model in smaller chunks. These easy to handle sections are then linked together to make the total plan. The change function provides the capability to modify any part of your model as needed. Duplication of your model files is made using instructions included in the BACKUP section.

Two printer driver options are provided in Desktop/Plan. Both are serial and include the use of the Communications card or the High Speed Serial card. The manual describes the procedure to use for customizing your configuration. Once you make the changes, you can delete several files

Desktop, cont'd . . .

from the catalog. More disk space is made available on your operating diskette this way.

Addition of the capability to automatically lock and unlock files and to delete unwanted 'trials' and development 'mistakes' would be helpful. Otherwise, your diskette catalog may become cluttered with unneeded entries. You can, of course, lock, unlock and delete catalog entries using the DOS commands.

What Wasn't So Good

First, let me state that, overall, this is an excellent software package. Most of my gripes are **not** of major consequence. But, there are some things that, from my point of view, are undesirable or lacking. Here's my brief list:

- There is no summary of operation steps in the manual. If you go through from beginning to end you will eventually press all the right keys. Once you have done this, though, there is no summary to lead you through quickly the next time. Any procedure having as much detail as Plan does should have a guideline summary of steps (for use when you're part way up the learning curve).
- A disclaimer that leaves you in doubt about the ultimate usefulness of the package. To flatly state that once you purchase the package you're on your own is somewhat counter-productive. You should expect support of software that is this extensive and involved. Correction of bugs and answers to what, why and how questions are minimum requirements.

  Although $95.00 is a more-than-fair price for this much planning capability, support to the customer is necessary. If the one-time charge is too low to cover follow-on service, then charge a nominal fee for the support. Most users would pay for the comfort of knowing they are not dangling loose out there.
- Master Diskette Quality. The one with my package was noisy and it had to be re-read three times in order to make a useable copy. If you want to save money in the long run use good quality diskettes. There are several manufacturers whose product quality exceeds the ANSI standards. The low-cost diskettes may be OK for the personal hobbyist. But, for revenue producing businesses that depend on reliability, don't skimp on diskette quality.

Conclusion

A final note — Desktop/Plan is not limited to financial planning. Any time-related calculation series can be implemented. For instance, production build schedules, material flow quantities and any numeric progression can be simulated. Also remember that the system can be customized. (This in addition to the special calculation features you can add.) Desktop/Plan has the potential to be a complete and creative simulation aide. In this regard, a progressive manager can take advantage of real-time data to aid in common sense decision making. □

Available from Personal Software, 592 Weddell Dr., Sunnyvale, CA 94086.

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Microsoft Adventure

Bill Cotter

By now, most computer enthusiasts are probably familiar with the computer game Adventure. Based on the increasingly popular board game of Dungeons And Dragons, the player must pit himself against unknown dangers (such as giant snakes, dragons and evil dwarves) to retrieve hidden treasures and escape alive. While many variations of the game exist, the original was written in Fortran for the PDP-11 series of computers, and was limited to those players with access to large time-sharing systems. The size of the necessary data bases prevented adaptation for the average home computer user, resulting in subsets of limited versions which were usually written in Basic.

It comes with its own operating system, providing all of the necessary file handling features and control routines.

Microsoft, a firm best known for its Basic interpreter on systems such as the TRS-80, Apple II and PET, has now released a complete version of Adventure for the TRS-80. Requiring at least 32K RAM of memory and a disk drive, Microsoft Adventure is written in Z-80 Assembly Language, and contains all of the game descriptions and variations of the original game. Credit for implementing the game is given to Gordon Letwin of Softwin Associates.

Supplied only on disk, Microsoft Adventure comes with its own operating system, providing all of the necessary file handling features and control routines. One disturbing aspect of this uniqueness is that the disk is impossible to duplicate or backup by conventional methods, including Superzap or several other utilities. Microsoft does guarantee to replace a damaged disk for $7.50, and states that they have taken steps to prevent what they call "hardware and disk operating system problems that sometimes occur with the TRS-80."

The game is started by placing the disk into the drive and powering up the TRS-80. An automatic loading routine starts the game by asking the user if the data from a previously saved game is to be used, and then provides instructions if required. In keeping with the spirit of the game, the instructions are intentionally brief, but provide enough detail to enable even a novice player to start.

From this point on the play continues exactly as on the large scale machines previously mentioned, with a comparison of the same moves on the TRS-80 and a PDP-10 yielding identical results. The response time was noted to be faster for the Microsoft version than on the two PDP-10's tested, which contributed greatly to the enjoyment of the game. One disturbing feature of the Microsoft implementation is the continual need to access the data table stored on the disk after each move, which could result in quite a bit of wear and tear on the disk and drive after extended usage. Another problem noted is the lack of any hardcopy listing of the game status or past moves, a feature almost essential to most Adventure players in determining their errors for their next attempt.

Once a player decides to end the game, a save routine is available to save two separate versions of play on the game disk itself (no storage is available for use on separate disks). This feature of writing on the actual game disk did not result in any problems during the review period, but certainly is upsetting in that a backup is impossible.

Microsoft Adventure is an excellent new addition to the list of games available for the small computer user, and certainly seems to be worth the list price of $24.95. Orders can be handled by dealers nationwide, or sent directly to Microsoft Consumer Products, 10800 Northeast Eighth, Suite 819, Bellevue, WA 98004. A series of booklets containing hints for those who eventually despair and need assistance (some say cheat±) is available from Softwin Associates, 545 - 108th N.E., Suite 6, Bellevue, WA 98004. □

One problem noted is the lack of any hardcopy listing of the game status or past moves.

Editor's note: Microsoft is currently advertising their product as "the only original Adventure for micros." Not true. It's not the only one, or even the first. Creative Computing Software has been marketing original Adventure for 8080 and Z80 systems on a CP/M floppy disk since the summer of 1979. Not only is it the complete original Adventure, but it plays in English or French, responds to "naughty" words with limericks, and has some other extensions.

Bill Cotter, P.O. Box 9449, Glendale, CA 91206.

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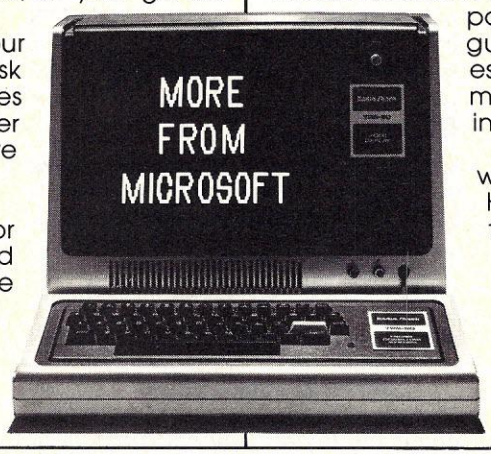
BASIC Compiler runs on your TRS-80 Model I with 48K and disk drive. The package includes BASIC Compiler, linking loader and BASIC library with complete documentation. $195.00.

*Microsoft royalty information for the sale of programs compiled with BASIC Compiler is available from Microsoft.



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Or to add fractions: ?1/3 + 5/6 + 2/5 + 3/7;

The instantaneous answer: 419/210.

Or to perform a more difficult trigonometric expansion you enter: SIN(2*Y)*(4*COS(X)↑3—COS(3*X) + SIN (Y)*(COS(X+Y+#PI) — COS(X—Y));

Just a few seconds later, the computer replies: @4*SIN(Y)*COS(X)*COS(Y).

muMATH has virtually infinite precision with full accuracy up to 611 digits.

If you use math, you'll find countless ways to save time and effort with muMATH. It's a professional tool for engineers and scientists. A learning tool for students at any level from algebra to calculus.

And if you want to expand your capabilities even beyond the standard muMATH, the option is open. muSIMP, the programming language in which muMATH is written, is included in the muMATH package. A superset of the language LISP, muSIMP is designed especially for interactive symbolic mathematics and other artificial intelligence applications.

muMATH and muSIMP were written by The Soft Warehouse, Honolulu, Hawaii. Priced at $74.95, the package includes muMATH, muSIMP and a complete manual. It requires a Model I TRS-80 with 32K and single disk. muMATH for the Apple II Computer will be available later this year.

You can buy muMATH and BASIC Compiler at computer stores across the country that carry Microsoft products. If your local store doesn't have them, call us. 206-454-1315. Or write Microsoft Consumer Products, 10800 Northeast Eighth, Suite 507, Bellevue, WA 98004.

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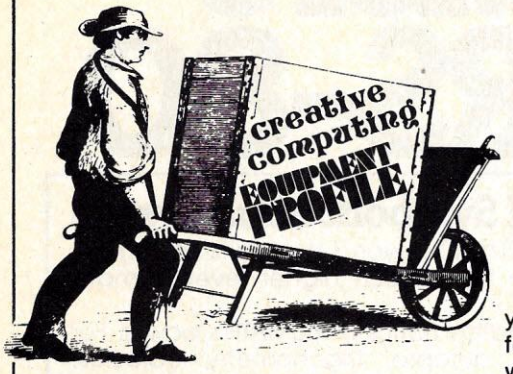


The APF Imagination Machine

Eric Van Horn

In the December '79 **Creative Computing,** Randy Heuer reported on the APF MP-1000 video game system. Since that time, APF Electronics has introduced a keyboard/cassette console that connects to the MP-1000 to make it into a full-fledged personal computer, the APF "Imagination Machine."

The IM-1, as APF calls it, offers all the features of the games system, including ROM-based video games, two game paddles with fire button and keypads, color graphics and sound. The keyboard is noticeably well made.

APF uses a two-track recording system for its cassettes similar to the one now being used by Atari in its 400 and 800 series computer systems.

The "touch" is good and there should not be any problems with keyboard bounce or rugged use as has been true of several other small computer systems. The MP-1000 fits into a cradle just in front of the keyboard. Immediately to the right of the MP-1000 slot is a built-in cassette deck. APF uses a two-track recording system for its cassettes similar to the one now being used by Atari in its 400 and 800 series computer systems. One track carries the binary program information while the other is available for audioplayback through the speaker located just below the cassette unit. APF uses the audio track for giving instructions on how to run a program while it is loading. This got somewhat tiresome after the fourth or fifth time we were loading a tape, but it is possible to poke a certain memory location to suppress the audio output. For your own use there is an audio jack so you can dub in your own instructions, sound effects or foolishness for the delight of people who are easily bored by loading cassette tapes. The cassette motor is computer controlled; data are loaded at 1200 baud. We did have problems with some of the tapes provided, but for the most part the cassette unit appears to be relatively reliable.

The basic screen format is 32 characters by 16 lines for alphanumerics, 64 x 32 pixels for low resolution graphics with eight colors, and two high resolution graphics modes. High res graphics mode #1 works with a grid size of 128 x 192 pixels and uses the same eight colors available in low res graphics. High res graphics mode #2 works with one color only but offers the greater density of 192 x 256 pixels. In either high res mode the resolution is certainly good enough for sophisticated graphics displays.

Low resolution graphics displays can be created in several ways, and they are very similar to the Imagination Machine's older cousin, the Apple. The simplest way to draw pictures is to use a series of PLOT commands. The PLOT command lights a graphics block on the screen in the form:

```
PLOT c,r
```

where c is the column and r is the row. To specify a particular color for a block, the COLOR command is used.

```
COLOR = 1
PLOT 3,3
```

will make a dark green block at row #3, column #3.

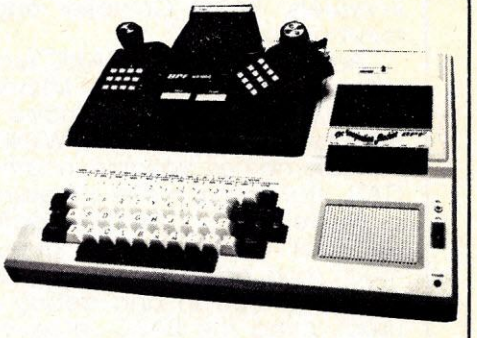
Low res graphics allows a higher degree of control by using a SHAPE command to light any combination of four smaller blocks, or pixels within each larger graphics block. The particular combination of pixels you want lit is specified by a number 0 through 15, 0 being no pixels lit and 15 being all pixels lit. The remaining pixels are always black, so it is not possible within one graphics block to mix colors.

Like the Apple, APF Basic also provides HLIN and ULIN commands to aid in drawing lines. HLIN and ULIN work in the form:

```
HLIN sc,ec,r
```

where sc is the start column, ec is the end column and r is the row number.

Another similarity to the Apple is the use of high res graphics. The IM-1



has two reserved areas of memory — not in RAM — for screen memory mapping and the shape table. The shape table is simply an area of memory reserved to store a predefined shape from which it can be called and poked into the screen memory map to be displayed. Up to thirty-two 4 x 16 shapes, each shape being the size of one graphics block, can be created. Without any additional

Low Res graphics allows a higher degree of control by using a SHAPE command to light any combination of four smaller blocks or pixels within each larger graphics block.

aids like a Bit Pad, working in high res graphics is probably more work than most people will want to undertake.

In addition to using the audio track on the cassette recorder, sounds can be generated using the MUSIC command. Up to two octaves can be "played" by specifying numbers 1-7 for the lower octave, and *1,*2,*3...*7 for the higher octave. Half tones are created by using the prefixes '+' for sharps and '-' for flats. Using spaces,

APF, cont'd...

zeroes or back slashes (\) changes the duration of notes. Because notes are contained in strings, they can be defined at the beginning of a program and called later. This program:

```
10 A$ = "3212333"
 :
 :
450 PRINT "YOU WIN"
460 MUSIC A$
```

plays the first phrase of "Mary Had a Little Lamb" whenever you win a game.

APF Basic is not noticeably different from the various implementations of Microsoft Basic on the TRS-80 (level II), PET and Apple (Applesoft). There are, however, some noticeable omissions. APF Basic does not have any of the trigonometric or higher math functions SIN(x), COS(x), TAN(x), EXP, LOG or ATN. Variable names may be up to 5 characters in length, as long as they do not contain imbedded key words, but Basic only recognizes the first two characters. Variables default to 13 digits of precision although they may be truncated by using the INT(x) function. Single precision variables and defined integer variables are not supported.

String variables can be up to 100 characters long and use the same variable name format as numbers. Unfortunately, APF Basic does not have LEFT$, RIGHT$ or MID$ functions. The omission of these string and the above numeric functions could cause problems depending on what you want to do. For example, programs like ELIZA and LEM from **Creative's** games books will not run without these commands.

The IM-1 comes with 10K of ROM and 9K of RAM with Basic contained in a plug-in cartridge. At present there are no peripherals available, but APF has plans to produce a 32K RAM expansion, serial port, 2 printers (high and low speed), mini-floppy disk drives (up to four on a machine) and a modem. It is difficult to tell when any of these items might be available, but so far APF has been reliable in producing promised products.

The IM-1 offers a solid, basic machine with color and sound. The documentation is woefully lacking — unfortunately all too common in the personal computer industry — so a novice programmer may want to beware. Still, at $599 the IM-1 offers a potential for graphics and sound along with a fair amount of available software (mostly games) at a reasonable price. For more information on the APF "Imagination Machine," contact APF Electronics at 444 Madison Avenue, NYC, NY 10022. □

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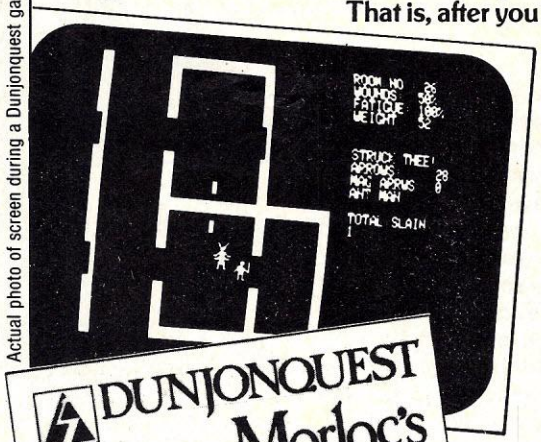
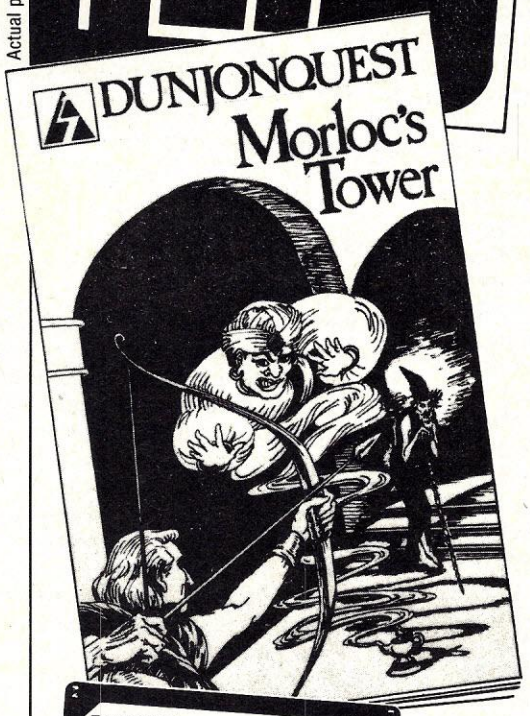


Actual photo of screen during a Dunjonquest game.



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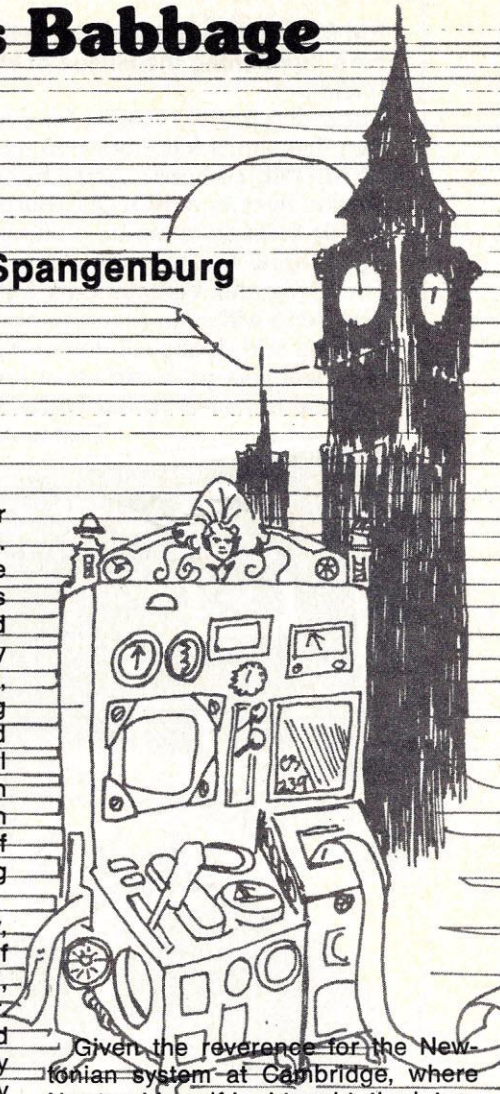
The Magnificent Demon of Charles Babbage

Raymond C. Spangenburg



Victorian England — the time for mad doctors of twilight fiction, Dr. Jekyll prowling the streets under the control of Mr. Hyde, resurrectionists plying their trade in dark alleys, and Sherlock Holmes locked in deadly fog-bound pursuit of the evil genius, professor Moriarty. An unlikely setting for the creation of a sophisticated computer? Certainly. But in a small workshed in the heart of London, an inspired and eccentric mathematician with the Dickensonian name of Charles Babbage was feverishly trying to do just that.

Babbage, one of those cranky, colorful, and brilliant personages of which Victorian England was so fond, was born in 1791 the son of a banker. Completely and passionately devoted to mathematics, he was educated by private tutors before entering Trinity College at Cambridge in 1810.

Startlingly self-assured and always a maverick, Babbage, along with his two closest friends, John Herschel and George Peacock, by 1812 founded the Analytical Society at

Victorian England was the time for mad doctors of twilight fiction.

Cambridge. The plan of the society was nothing less than to revolutionize English mathematics by introducing the modern methods of infinitesimal calculus championed in France and Germany, but neglected in England in favor of the traditional but awkward Newtonian "calculus of Fluxions."

Raymond C. Spangenburg 525 Hillside Boulevard, South San Francisco, CA 94080.

Given the reverence for the Newtonian system at Cambridge, where Newton himself had taught, the intentions of the Analytical Society were radical indeed. But Babbage, Herschel and Peacock, who once vowed jointly to do their best to leave the world wiser than they found it, were so persuasive in their arguments that within five years they saw not only Cambridge, but other schools converting to the modern methods as well.

It was a heady victory and one that assured prominence for its three leading advocates. Herschel, the son of astronomer William Herschel, followed in his brilliant father's footsteps in astronomy and government. Peacock found his niche in the ministry. And Babbage dreamed greater, if more quixotic dreams.

The dream would devour his wealth and inheritance, would obsess him for the rest of his life and would turn him from an inquisitive, intelligent, healthy young scientist into a bitter and frustrated old man.

Irritated by the many errors that cluttered logarithmic tables and astronomical calculations, Charles Babbage began to dream of a machine that would eliminate those errors by handling the often tedious calculations more efficiently. Pascal and Leibniz before him envisioned and even constructed simple machines for such calculations, but Babbage had a much larger picture in mind. The idea would completely dominate the next 20 years of his life. Giving it the now humorously quaint name of "The Difference Engine," Charles Babbage set out to make himself a computer.

Given the technology and hardware of the time, the dream was magnificently quixotic. More bizarre was the

Babbage dreamed great quixotic dreams.

fact that somehow he convinced the British government to help foot the bill! Without the aid of chips, vacuum tubes, or even electricity, Babbage outfitted the workshed he convinced the government to build for him, and set to work building his computer.

It was a job that would never see a finish. Inspiration and genius are fine tools and on paper the "Difference Engine" moved beautifully. Constructed of gears, cogs, axes and intricate combinations and meshings, the Difference Engine of Babbage's vision would not only perform calculations, based on the principle of constant differences, but would do so up to a 20-place capacity, present an answer in an answer column and even stamp the answer on a copper engraver's plate! It all looked fine, if incredibly complex — **on paper** — and draftsmen today still consider Babbage's diagrams to be among the finest examples of mechanical drawing ever executed. But turning the Difference Engine into reality was a much greater problem.

Reality was just not ready for Charles Babbage's vision. The existing technology of his time was crudely efficient, but not efficient enough to handle the fine tooling and delicate

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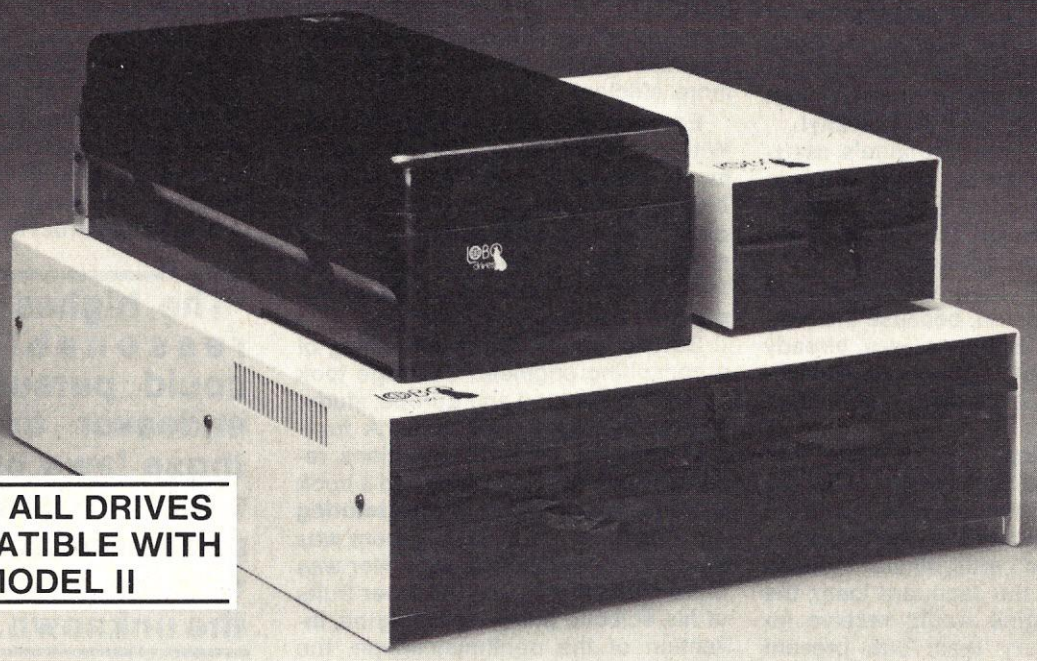

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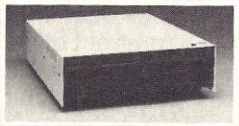

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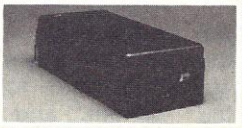

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Demon, cont'd . . .

complexity of a clockwork machine to be made to incredibly fine-gauged standards and to be constructed of over two tons of hand-tooled ratchets, cams, links, shafts and wheels. Dr. Frankenstein in his laboratory might have boggled at such complexity!

No doubt so did Babbage's assistants who, when a salary dispute arose, took the chance to collect their tools and abandon the furious Babbage to his own devices.

"Devices," in more ways than one, and certainly plural, because the restless mind of Babbage was already pursuing another path — the Analytical Engine, an even more magnificent vision.

The Analytical Engine would not only calculate but would possess a "store" or memory along with its "mill" or calculating mechanisms. Using punched cards, similar to those then in use in the Jacquard loom, the Analytical Engine would receive instructions, carry them out, present answers and even be able, in Babbage's own words, "to eat its own tail" — that is, to alter its own stored program on the basis of its calculations.

The whole thing was a little too much for the British government, particularly since the "Difference Engine" had only partially been completed. The new monster was beyond reason and financial support.

Moral support came, though, in the form of Babbage's new associate, the daughter of Lord Byron, Lady Augusta Lovelace. A brilliant but ill-fated young woman, Lady Lovelace had been introduced as a child to Babbage and his Difference Engine when her math tutor had arranged a tour of Babbage's workshed. The impressions of that first meeting produced mutual admiration. A "natural" and gifted mathematician, Lady Lovelace grasped quickly what her eccentric elder was up to with his machine. On his part, the by then somewhat cranky Babbage appreciated the quick child who asked intelligent, not foolish, questions.

In 1842 the Italian military engineer L. F. Menabrea, who attended one of Babbage's public lectures on the Difference Engine, published an article in French, which Lady Lovelace, by then a young woman, translated into English with annotations. Her translation and insightful annotations so impressed Babbage that he asked her to join him in his work. It's primarily through this article that we have a fairly complete understanding today of Babbage's machines.

It wasn't long until Lady Lovelace became as obsessed with the Babbage machine as Babbage himself, even calling it "this first child of mine." At her suggestion, Babbage abandoned the awkward decimal system he had been using in favor of the more efficient binary system.

Enthusiasm wasn't enough, though. With government support gone, money was a problem. Most of Babbage's own private funds were depleted in the intervening years of struggle and, by the time Lady Lovelace arrived on the scene, the enterprise was at a near standstill.

Setting himself up as something of a consulting engineer, Babbage took to touring England and Europe, studying manufacturing methods. A forerunner of the modern operations research specialist, he published a book entitled **Economy of Manufacturing and Machinery** in 1832, but there was little money in the endeavor. Nor was there much profit from the other fruits of his eclectic mind, including his invention of the ophthalmoscope, the cow-catcher, the modern postage system based on a flat rate of charges (rather than the distance a letter was to travel), or his brilliant, comprehensive treatise on actuarial tables which would form the basis of the modern life insurance business.

Since such useful but mundane pursuits brought in little money for their project, Lady Lovelace and Babbage were not above more colorful and risky endeavors. Babbage, who had taken to catigating 'street nuisances" and chasing organ-grinders down the alleys with his cane, also so alienated the government and other possible backers that desperate measures were called for.

Dr. Frankenstein in his laboratory might have boggled at such complexity!

One of their plans was to build an automatic tic-tac-toe player which would be sent on tour to take on all comers while, of course, charging admission to the game. But little study into the matter convinced them, reluctantly, that the time and investment wouldn't pay itself off soon enough. Their final plan, and certainly the most desperate, led to tragic results.

Lady Lovelace and her husband, Lord Lovelace, were devotees of the horse race. With child-like enthusiasm, Babbage's collaborator, along with the eclectic Babbage himself, spent hours attempting to devise a winning system based on probability theory. When their first attempts were successful, their enthusiasm grew. Babbage, not constitutionally given to the sport, managed to keep a respectable distance, but Lady Lovelace, inheriting her father Lord Byron's love of adventure, soon became helplessly trapped. Caught between her belief in Babbage's engines, and the need for money to construct them on one hand,

"The highest object a reasonable being could pursue was to endeavor to discover those laws of mind by which man's intellect passes from the known to the discovery of the unknown."

and her own growing addiction to horse-racing on the other, Lady Lovelace quickly became a compulsive gambler. With the losses that inevitably followed, her health began to fail. By 1852 she had three times been forced to pawn her jewels to pay off racing debts and was showing signs of serious illness. Cancer tragically took her life at age 36.

Left alone with his dreams and partially completed machines. Charles Babbage spent the rest of his life a bitter and frustrated man. When he was past 70, writing in his autobiography, **Passages from the Life of a Philosopher,** he claimed not to be able to remember one completely happy day in his entire life. Of his magnificent demon itself? Babbage wrote sadly that he had written the autobiography to make "less unpalatable" the story and history of his calculating machines.

Self-judgment was harsh. Harsher certainly than history now reflects. A genius before his time, with an idea that was too far ahead of technological development to bear fruit, Babbage was at that forefront of men who, as he wrote in the final pages of his autobiography, possessed the conviction that "the highest object a reasonable being could pursue was to endeavor to discover those laws of mind by which man's intellect passes from the known to the discovery of the unknown."

No more fitting epitaph for Charles Babbage could ever be written. □

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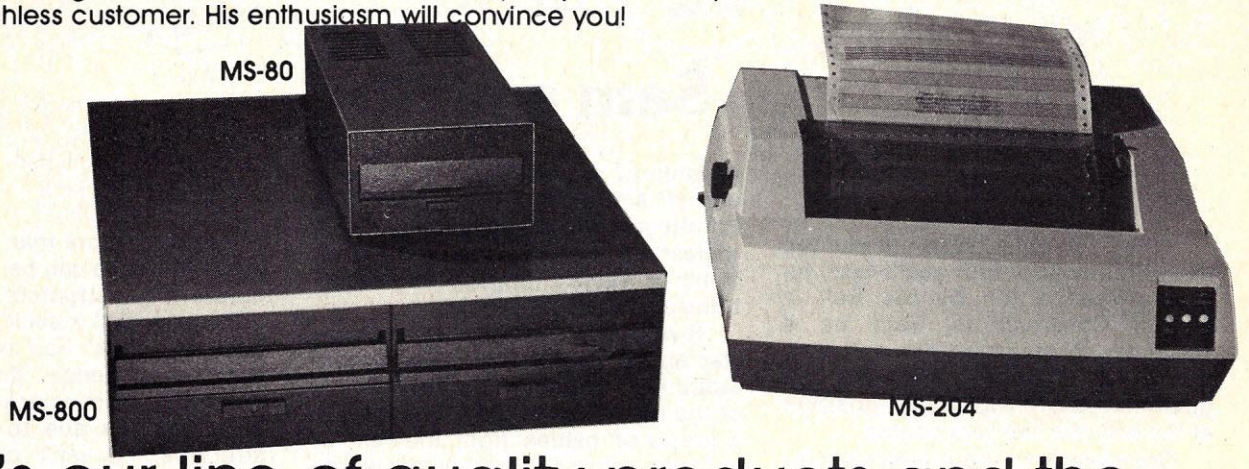

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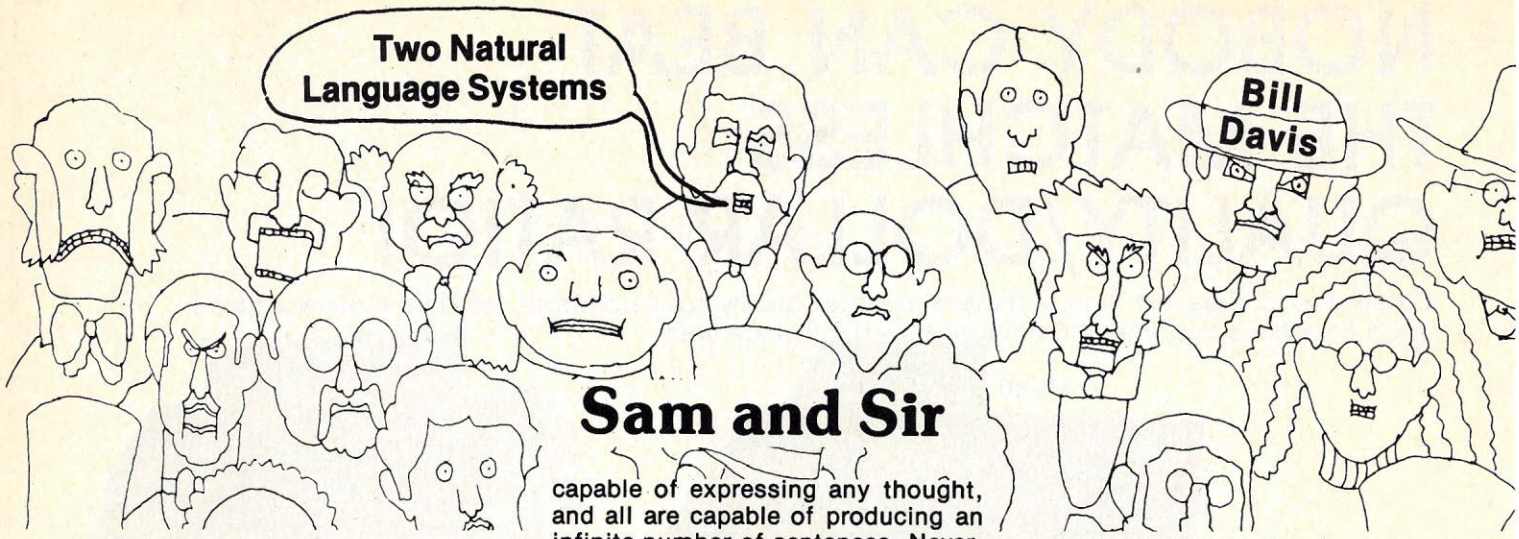

Sam and Sir

When Byron Folse graduated from high school four years ago, he was offered a job by the Bell & Howell Company to train as a computer programmer. The company would pay him $200 a month and guarantee a $12,000 a year position at the end of a two year course.

Computer training programs subsidized by large corporations, and programming schools in general, turn out a great number of programmers each year. But the large market for programmers may soon be depleted, because the skills for mastering the various complex languages of the computer world may not be necessary in the long run.

"The middleman is slowly being eliminated in businesses that deal with computers," said Folse, now a computer science major at the University of Kansas, "In twenty years, most computers will be leaning toward the use of natural languages. They'll be speaking English."

Ten years ago computer use was restricted to designers and engineers working in specialized fields. As technology increases, computer costs decrease, and it is likely that ten years hence the computer will become as commonplace as the telephone. Consequently, computer systems will be adapted to fit the needs of small business and the individual. The easiest system for accommodating the masses will be a system the user is already familiar with, his own native tongue, rather than the more basic computer languages such as Fortran (Formula Translation) and Cobol (Common Business Oriented Language).

But the complexities involved in putting a natural language on a computer program are immense. There is no such thing as a primitive language, in that all languages are capable of expressing any thought, and all are capable of producing an infinite number of sentences. Nevertheless, it would be a mistake to think of human language as something immune to analysis.

It was once thought that language was an instinctive thing. To demonstrate this notion, King Frederick II of the Holy Roman Empire separated a group of babies from the rest of society, commanded that no words be spoken in their presence, and waited to see what natural language the children would speak.

The experiment failed, all the children died within a few years, and none ever spoke. Language is something learned through association of ideas and sounds, so by recreating these associations such knowledge can eventually be transferred to a computer program.

In twenty years, most computers will be speaking English.

The transition will not be an easy one. The first attempt to program a computer in English was begun at Harvard in 1951. Designed to translate foreign languages into English, the computer had access to complete dictionaries of Russian and English. Also incorporated were basic grammatical features such as word order, (subject-verb-object) noun cases and verb tenses. But the computer could not translate sentences without changing the meaning. The now famous example of Harvard's translation of the biblical quotation "The spirit is willing but the flesh is weak," was translated into Russian and then back into English to read, "The wine is agreeable but the meat has spoiled."

"The trouble with the early Harvard experiments," said Donald Lewis, a linguistics major at KU, "was that they couldn't deal with syntactic ambiguity. Not only do different words have more than one meaning, but a sentence can be ambiguous by nature of the structure. For instance, 'John gave Bill a sock' is ambiguous because 'sock' has two meanings, but the sentence 'the man wants protection from attack by the police' is ambiguous due to the syntactic structure." It isn't clear from the sentence itself whether the man wants the police to protect him or if he fears that they, the police, will attack him.

Lewis contends that, in fact, the line between semantics and syntax is hard to define. Form and meaning are interrelated in obscure ways. Even if the computer could be fully taught English grammar, there would still be ambiguities resulting from changes in tone of voice and the inflection of certain syllables.

To cope with these problems, Harvard linguists designed in the early 60's the most comprehensive phrase structured grammar ever programmed. The system produced four different interpretations of the sentence, "Time flies like an arrow." The sentence could mean that time moves in the same manner as an arrow moves, or that a particular breed of flies are fond of arrows. It could also mean the speed of a fly is measured the same way as the speed of an arrow, or the sentence could be read as a command to measure the speed of flies which resemble arrows.

Obviously, a program with any practical value will have to do more than list the possible meanings for each sentence. No matter what natural language systems are used for: banking, engineering, educating, or playing games, the system will have to be able to ask questions of the user to resolve ambiguities and key the computer to the context of the conversation. Even more important will be the capability of drawing causal inferences from general statements.

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Languages, cont'd...

There may be information contained in two sentences that isn't explicit in either one. Suppose we have, "John was mowing the lawn. Suddenly he felt a pain in his toe." How is the computer supposed to be able to infer what has happened? Like any syntactic feature, we must understand causal connections ourselves if we hope to put them down on paper for a program.

Roger Schank, of Yale, has invented a program that can draw on a huge backlog of information and connect events and places. SAM (Script Applier Mechanism) can understand stories and infer causes that are not directly stated. SAM can then paraphase the stories and explain it's conclusions.

When the following was typed into SAM, "John went to a restaurant. He ordered a hamburger. The hamburger was cold. John left a small tip." The program paraphrased, "John went to a restaurant. The hamburger he ordered was cold. John was displeased and left a small tip." Similiarly, given the input, "John went to a restaurant. He sat down, He got mad. He left." SAM reasoned, "A waiter did not go to the table. John became upset and left the restaurant."

SAM has an excellent memory. It can analyze hundreds of sentences simultaneously, but sometimes draws false conclusions. For example SAM once said, "Harriet went to Jack's birthday party. The cake tasted awful. Harriet left Jack's mother a small tip."

Such difficulties occur despite SAM's continuing improvement. But as Schank described in his 1975 research report, "SAM handles boring little stories. Theory must be developed to help detect the point of a story." The computer, like the human mind, must differentiate between facts that are important and those that aren't.

The ability to infer conclusions over a wide range of subjects belongs, for the most part, to humans only.

Schank is convinced the next step in computer development of natural language will be a good theory of forgetting. "Just what people choose to remember of a novel they read is significant towards telling us what is most important about a text and what can be filled in later," he said.

Other natural language systems are showing promise. MIT has invented a Semantic Information Retrieval (SIR) program capable of structuring facts according to such categories as ownership, part-whole, number and spatial position. SIR can deduce, for example, by the input that people have ten fingers, that an individual also has ten, five fingers on each hand. Although SIR does little more than regurgitate information in a paraphrased form, it's significance lies in the vast number of synonyms it can produce. Thus, even an entire novel can be re-written by computer, although not in an especially creative style.

The Artificial Paranoid said that the Mafia is out to get him.

Perhaps the most unique system is an exclusive of Stanford University, in which a pre-determined set of responses is programmed that simulates the behavior of a paranoid person. Put together mostly for the fun of it, the "person" has produced some humorous conversations. A KU linguistics student fortunate enough to get to talk to the Artificial Paranoid said the program continually repeats the phrase that the Mafia is out to get him. Whenever the program is questioned for evidence of a Mafia conspiracy it replies, "You don't believe me, do you?"

But the Artificial Paranoid simply says the same things over and over. Even the most elaborate natural language systems, such as SAM and SIR, can at best only re-phrase sentences and stories on a narrow level. Part of the problem of getting a computer to speak English is that any given sentence (Time flies like an arrow) has a number of different meanings, depending on the context of the conversation. Depending on the purpose the system is designed for, it must have a narrow set of grammatical rules restricting terms to a few specific definitions. Most are forced to limit the scope, or number the definitions of a word in order to rule out irrelevent material.

The best way to begin this process is to establish basic semantic categories, dividing each word into the Countable, the Edible, the Animate, or the Human. Rules of grammar can then tell the computer exactly in what context the word applies. They can specify that the action "eat," is to apply only to the Edible, and so on.

If definitions are never restricted, the computer will always become confused, because no program designed for a practical purpose can accept as part of its vocabulary every known definition without reference to some context. In SAM's program, the tip that John left in the restaurant can only have one real definition. If the word "tip" did not always mean, for SAM, an amount of money, the program would have no way of distinguishing a tip left in a restaurant from the tip of an iceberg, or from the act of tipping one's hat.

There are about twenty linguistics students and computer science majors, including Byron Folse, who are working jointly at the University of Kansas on natural language development. Folse says it is just a matter of time before systems are invented that will go beyond SAM and SIR.

"Computers already have an artificial intelligence in terms of memory," he said. "If a person reads a story from the SAM program he'll remember maybe eighty or ninety per cent. SAM's understanding is pretty much limited to restaurants and lunches, but within it's domain it has total recall."

Although systems based on mathematics have always had unlimited potential in the fields of accounting and engineering, unfortunately no system based on human language has yet found a practical application. The ability to infer conclusions over a wide range of subjects belongs, for the most part, to humans only. In a comprehensive, ideal situation, a computer would be able not only to interpret meaning through sentence structure but have receptors for picking up the actual sounds and weighing voice inflections. The real test for a system that closely resembles a human mind would be for a person to be isolated with a computer terminal and let him communicate, first with a real person, then with the computer system. A perfect system could grasp and respond to information, anger, an anecdote, or a joke, with the subject at the terminal unable to tell whether he was conversing with man or machine. □

A third natural language program, ELIZA, originally written by Joseph Weizenbaum at MIT, has been widely discussed in books and magazines. (See ***Creative Computing****, Vol.3, No.4, pg.100 and Vol.6, No.I, pg.62.)*

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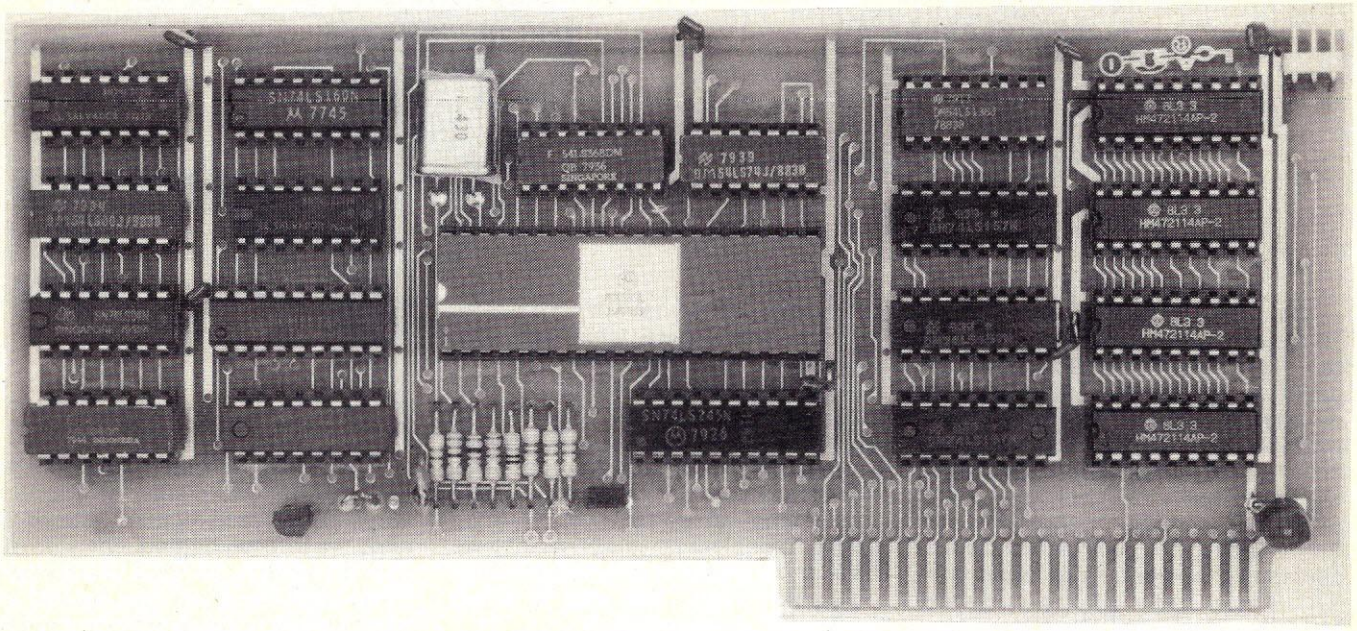

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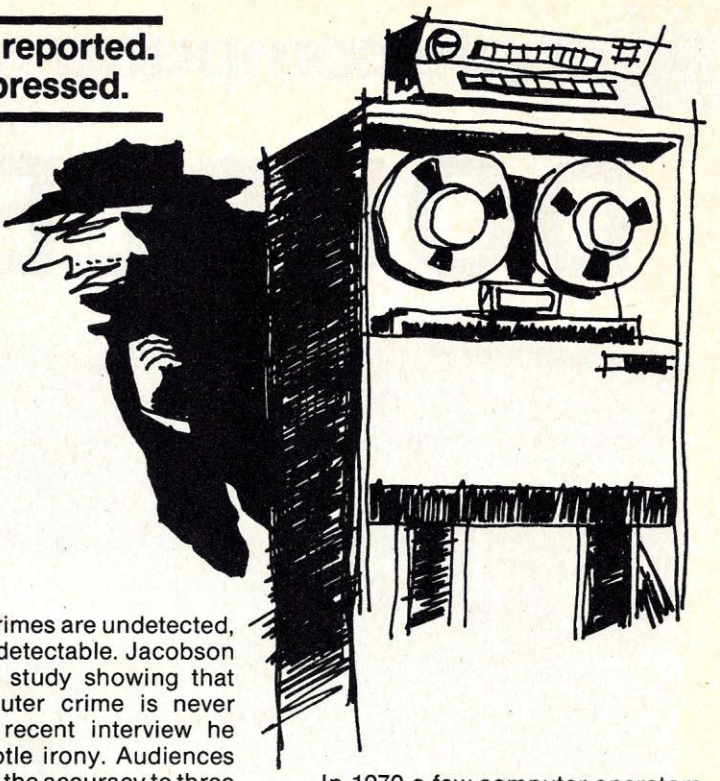
Less than 5% of computer crimes are reported. The rest are either successful or suppressed.

How Safe Is Your Computer?

David E. Powers



Jerry Schneider called Pacific Telephone's computer and punched some buttons on his phone. In the 2 AM darkness a telephone company truck dropped a $25,000 switchboard at a manhole. Jerry's own van later hauled it to his warehouse where he added it to a growing stock of stolen equipment. Schneider combined expertise, audacity and luck to penetrate the phone company's computerized order system. Every night phone company employees dutifully filled his dialed orders, disguised as legitimate requests from other departments. Schneider built a million dollar communications business on stolen inventory. One of his employees, fired over a salary dispute, exposed him. Otherwise the fraud may have continued for years. Pacific Telephone didn't realize it was being plundered.

Schneider now runs a computer security service, a promising industry, for his fraud against Pacific Telephone represents an increasing number of crimes by computer. Donn B. Parker of SRI International, a non-profit California research corporation, has investigated over 700 cases of computer abuse. Parker's data came from reliable sources, but he knows many more incidents have escaped attention. "Almost every case we have has been discovered accidentally," Parker says, and few discovered cases are reported. Victims, banks especially, fear they will lose public confidence if people know they are vulnerable to computer crime.

Robert V. Jacobson heads International Security Technology, a private consulting firm in New York. He observes that some cases of computer crime receive attention only "because they're easily discovered or the criminal was inept or wanted to be caught."

David E. Powers, 10 Wilben Ct., New Hyde Park, NY 10040.

Most computer crimes are undetected, possibly even undetectable. Jacobson used to quote a study showing that "86.2% of computer crime is never detected." In a recent interview he lamented the subtle irony. Audiences never questioned the accuracy to three significant figures of a statistic on "something we don't know anything about." Jacobson's guess is that we hear of only four or five percent of all computer crime. The rest is either successful or suppressed.

Boldness of known computer frauds staggers investigators. Senator Abe Ribicoff, who has introduced federal legislation to deal with computer abuse, observes that "crime by computer is relatively new. But when it strikes it is not shy." Donn Parker estimates the average loss from a bank-related computer crime at $450,000. Others suggest the mean loss from a computer fraud outside the banking industry exceeds $600,000.

In 1971 the Penn Central Railroad lost 217 boxcars. Someone had modified computer input to classify them as scrapped and to divert them to a siding of a tiny railway where thieves — possibly organized crime — emptied them, disposed of their contents and prepared them for sale or lease to another railroad. The loss was in the millions.

A teller at the Union Dime Savings Bank in New York used a supervisory program to alter customers' accounts. If any depositor complained of an incorrect balance, the teller moved money from other accounts to the customer's. Routine audits never caught him. The bank discovered his fraud only when police raided the teller's bookie and found his name on a list of heavy betters. He had gambled embezzled money, often as much as $30,000 daily. Before the fraud ended the teller had stolen over $1.5 million.

In 1979 a few computer operators and parimutuel clerks at Florida's Flagler Dog Track regularly altered the odds in trifecta betting pools to net over $2 million for each conspirator. Since their fraud touched neither the track's share of the pool nor the state's, but stole from other winners, auditors never suspected it. They were caught because one of them boasted of the scheme.

In 1971 the Penn Central Railroad lost 217 boxcars. Someone had modified computer input to classify them as scrapped and to divert them to a siding of a tiny railway where thieves — possibly organized crime — emptied them, disposed of their contents and prepared them for sale or lease to another railroad.

Computers, of course, are not criminals; people are, and scores of experts argue that computer fraud is better labelled "computer assisted fraud," as M. Blake Greenlee, Vice President of Citibank, calls it. Still, public ignorance about computers creates a nurturing environment for abuse. Managers, auditors and consumers hesitate to question neat

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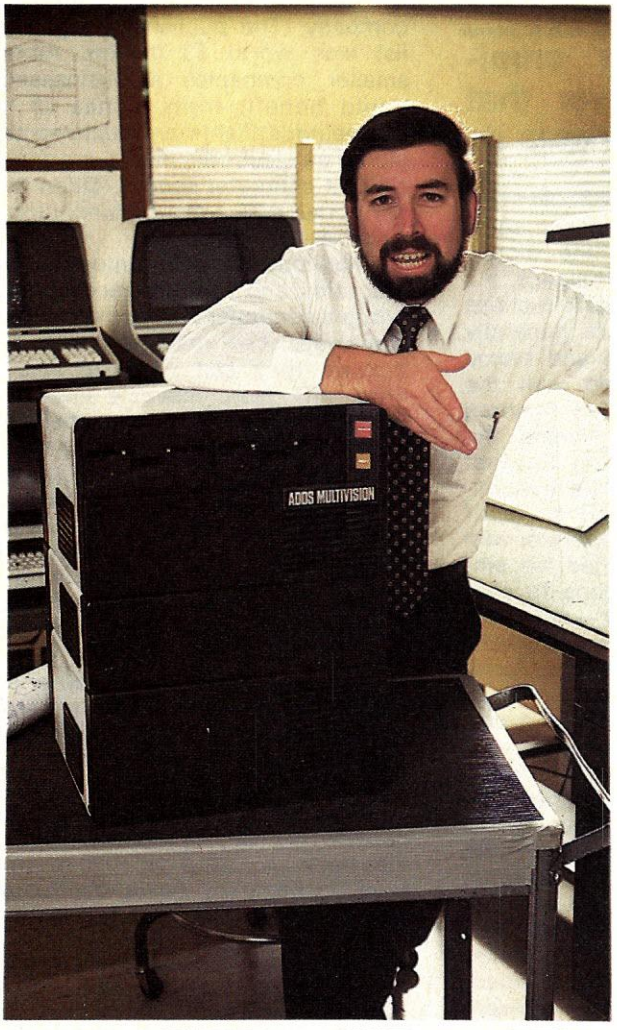

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Safe, cont'd . . .

computer output. They are incredibly accurate machines whose complexity intimidates casual users but offers a haven to enterprising thieves.

Computhieves do not fit criminal stereotypes. They are bright, young and motivated people, energetic and ambitious, the kind personnel directors love to hire. Rarely do they regard their crimes as harmful. At first the teller in the Union Dime case never took more from any depositor than was covered by federal insurance. Some computer criminals rationalize their acts as protests against an uncaring system, or trivialize them as crimes against impersonal devices. Donn Parker calls it the "vending machine syndrome." In England an electronic thief's barrister depicted his client as victim and the computer as an inhuman horror.

Few computer criminals are caught. Fewer suffer serious punishment. Chances of going to jail are less than one in a thousand. Before computerized account maintenance every transaction left an audit trail, a record of the transaction and its disposition that auditors could follow. Electronic data processing rarely leaves clear trails. Paper bookkeeping systems do not permit erasures, but computer media are inherently erasable. Some computer criminals are so clever that their crime eliminates its own evidence. Jerry Schneider's phone company fraud included instructions to destroy records of his orders.

Microcomputers may not suffer identical abuses that time sharing systems face, but they are still vulnerable. Along with the $2 billion Equity Funding scandal, Parker's research includes hundred dollar crimes. Michael Wilson, Special Agent and computer crime expert in the New York office of the F.B.I., believes that "small systems are more dangerous than the big ones." Financial fraud, theft of data or property and computer vandalism are real threats. Security expert Robert Jacobson says that "small business systems represent an absolute bonanza for the embezzler." A clever one will turn a small business into a small disaster.

Workers can apply similar techniques to defraud with micro systems as have been used with large computers. Suppose an employee desires a raise but has been unable to convince the boss. Given access to his employer's computer the disgruntled employee can arrange a modest increase on his own. The standard way is to alter stored pay rates or hours worked, "data diddling," it's called. Playing with input requires little skill.

Some varieties of computer fraud involve patches in the computer operating system or modifications to critical programs. Donn Parker describes a "salami" technique as "a truly automated crime." Using electronic data processing an embezzler may hit many accounts for small slices over a long time until he has concluded a substantial theft. Parker cites a bank which suspects it is the victim of a salami. Random accounts are irregularly and inexplicably debited with

Some computer criminals are so clever that their crime eliminates its own evidence.

minuscule sums. Presumably some other account receives the money since the bank's records balance. If a patron complains, the bank rectifies the error, but customers generally accept computer output and blame their own figures. Living with the salami costs the bank a few hundred dollars annually, while finding the embezzler and searching for lost assets might cost substantially more.

Salamis work in all sorts of businesses. A computer operator with programming skill modified his employer's payroll instructions to subtract slightly too much tax — unnoticeable amounts — from his coworkers' checks and to credit the excess funds to his withholding account. As far as the employer could determine, everything balanced. At the end of the year all W-2 forms except the thief's reported smaller deductions than had actually been withheld. When his IRS refund check came in the mail, the employee collected the proceeds of his fraud. Normal auditing missed the individual thefts, but a janitor who wouldn't slavishly accept computer output recalculated his own deductions at year's end and led to discovery of the fraud.

Knowledgeable employees could alter a payroll program to benefit from intentional mathematical errors. In larger organizations they might create fictitious employees and issue fraudulent paychecks. A documented case describes a programmer who inserted a logical time bomb into payroll software and invented his own variety of unemployment insurance. Six months after his social security number ceased to appear on the payroll the computer would begin sending him paychecks again. Others have awarded themselves handsome severance payments or oversized pensions.

Valuable information lures thieves and swindlers, too. In 1973 a former employee stole computer tapes of vital data from a West German firm and offered to return them for a $200,000 ransom. The kidnapping succeeded because a business is paralyzed if its managers cannot access information on accounts, inventory, payroll, marketing plans, customers' needs — the variety of data computers store.

Operators have stolen data for resale. In the early 1970s three employees of Encyclopedia Brittanica copied a three million name mailing list of favored customers from a computer file and sold it to a direct mail company. The publisher alleged the list was worth $3 million. Among smaller companies a businessman could benefit from names of his competitor's clients, and such records, stored on electronic media, are accessible at computer speeds. Often they are portable as a five-inch minifloppy diskette.

Manipulation of inventory control programs and account records have brought computer thieves big profits. If employees can make off with 217 boxcars they can victimize smaller firms with more movable inventory. Operators can steal merchandise reclassified as broken, sold or otherwise unavailable. Shipping record programs usually include procedures to assure customers of prompt delivery. Rarely do they contain audit controls adequate to determine if orders are real and accompanied by invoices charged against receivable files.

More difficult to execute are crimes in which computer operators fabricate purchase orders to substantiate fraudulent invoices from dummy vendors. The offending employee controls the dummy companies and collects his employer's payments at the bank. A computer expert at a trucking company drove the dummy vendor road to a $1 million embezzle-

Shipping record programs usually include procedures to assure customers of prompt delivery. Rarely do they contain audit controls adequate to determine if orders are real and accompanied by invoices charged against receivable files.

ment. An employee of a Long Island insurance company enjoyed large unscheduled benefits using similar techniques.

Sabotage and vandalism threaten users of all system types and sizes. The history of physical vandalism tells of

Safe, cont'd . . .

computers which have been burnt, bombed, shot and stabbed. One university computer suffered expensive damage when a student assaulted it with a milkshake. Microcomputer users may not fear overt physical acts, but sabotage can take subtle forms. A discharged programmer left a logical time bomb in his employer's operating system: two years later all data files would be destroyed. A fired computer librarian for an insurance company intentionally mislabelled all tapes in her charge. The company spent hundreds of thousands of dollars to examine and relabel its tapes. Other acts of sabotage include destruction of magnetic media or malicious alteration of their contents.

Even advanced systems invite abuse and compromise. The Department of Defense, for example, has hired "tiger teams" to invade its computers and steal classified information. Private computer users have tried similar projects to find and correct weaknesses before criminals discover them. Experts seem to agree that currently no computer installation will withstand determined effort to compromise it, provided the potential abuser is willing to devote the needed time, money and personnel to the task. Police agencies are finding it difficult to keep pace with criminals. Computer fraud, Donn Parker says, makes a "moving target, and while law enforcement communities figure out how to handle today's crimes, we've got crooks out there figuring out how to do tomorrow's."

Although microcomputer security lags far behind larger systems, many problems are similar. Management ignorance accounts for the most serious flaws in computer systems. FBI Agent Michael Wilson says that "proprietors of small businesses generally

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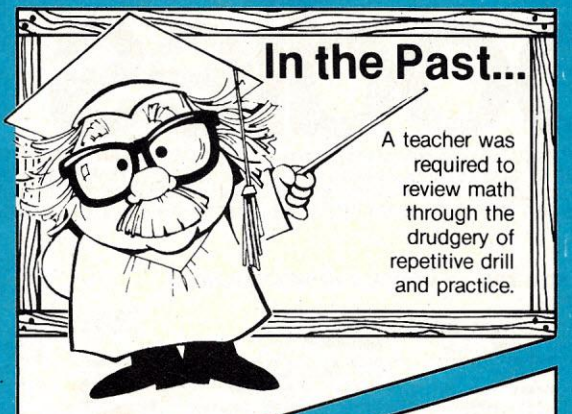

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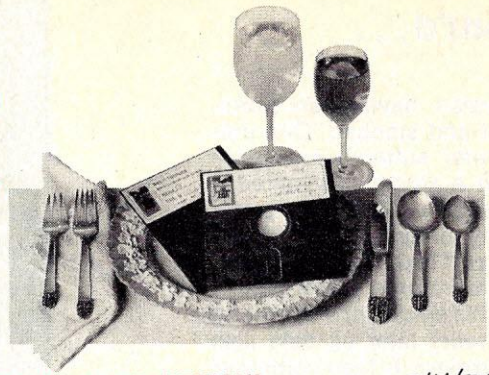

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Micropolis Mod I	1.4	145/25 v
Micropolis Mod II	1.4	145/25 v

The following configurations are scheduled for release during the first half of 1980:

North Star Double/Quad + Corvus	2.x	250/25
North Star Horizon HD-1	2.x	250/25
Ohio Scientific C3	2.x	200/25
Ohio Scientific C3-B	2.x	250/25
Ohio Scientific C3-C	2.x	250/25
Micropolis Mod II	2.x	200/25
Mostek MDX STD Bus System	2.x	350/25 **
iCOM 3812	2.x	225/25 *
iCOM 4511/Pertec D3000	2.x	375/25 * +
TRS-80 Model II + Corvus	2.x	250/25

*Software consists of the operating system, text editor, assembler, debugger and other utilities for file management and system maintenance. Complete set of Digital Research's documentation and additional implementation notes included. Systems marked * and ** include firmware on 2708 and 2716. Systems marked + include 5440 media charge. Systems marked Ⓜ require the special Ⓜ versions of software in this catalog. Systems marked v have minor variants available to suit console interface of system. Call or write for full list of options.*

☐ **MP/M*** — Intel MDS single density only (Documentation includes CP/M 2.0 manuals) ..... **$300/$50**

☐ **Z80 DEVELOPMENT PACKAGE** — Consists of: (1) disk Ⓜ file line editor, with global inter and intra-line facilities; (2) Z80 relocating assembler, Zilog/Mostek mnemonics, conditional assembly and cross reference table capabilities; (3) linking loader producing absolute Intel hex disk file ..... **$95/$20**

☐ **ZDT** — Z80 Monitor Debugger to break and examine Ⓜ registers with standard Zilog/Mostek mnemonic disassembly displays. $35 when ordered with Z80 Development Package ..... **$50/$10**

☐ **XASM-68** — Non-macro cross-assembler with nested conditionals and full range of pseudo operations. Assembles from standard Motorola MC6800 mnemonics to Intel hex ..... **$200/$25**

☐ **XASM-65** — As XASM-68 for MOS Technology MCS-6500 series mnemonics ..... **$200/$25**

☐ **DISTEL** — Disk based disassembler to Intel 8080 or TDL/Xitan Z80 source code, listing and cross reference files, Intel or TDL/Xitan pseudo ops optional. Runs on 8080 ..... **$65/$10**

☐ **DISILOG** — As DISTEL to Zilog/Mostek mnemonic Ⓜ files. Runs on Z80 only ..... **$65/$10**

☐ **SMAL/80** Structured Macro Assembler Language — Ⓧ Package of powerful general purpose text macro processor and SMAL structured language compiler. SMAL is an assembler language with IF-THEN-ELSE, LOOP-REPEAT-WHILE, DO-END, BEGIN-END constructs ..... **$75/$15**

☐ **tiny C** — Interactive interpretive system for teaching Ⓧ structured programming techniques. Manual includes full source listings ..... **$105/$40**

☐ **BDS C COMPILER** — Supports most features of lan- Ⓜ guage, including Structures, Arrays, Pointers, recur- Ⓘ sive function evaluation, overlays. Includes linking loader, library manager, and library containing general purpose, file I/O, and floating point functions. Lacks initializers, statics, floats and longs. Documentation includes "The C PROGRAMMING LANGUAGE" by Kernighan and Ritchie ..... **$125/$20**

New Features

☐ **WHITESMITHS C COMPILER** — The ultimate in sys- Ⓛ tems software tools. Produces faster code than a Ⓧ pseudo-code Pascal with more extensive facilities. Conforms to the full UNIX* Version 7 C language, described by Kernighan and Ritchie, and makes available over 75 functions for performing I/O, string manipulation and storage allocation. Linkable to Microsoft REL files. Requires 60K CP/M .... **$630/$30**

Software with Manual / Manual Alone

MICROSOFT

☐ **BASIC-80** — Disk Extended BASIC, ANSI compatible Ⓛ with long variable names, WHILE/WEND, chaining, Ⓜ variable length file records ..... **$325/$25**

☐ **BASIC COMPILER** — Language compatible with Ⓛ BASIC-80 and 3-10 times faster execution. Produces Ⓜ standard Microsoft relocatable binary output. Includes MACRO-80. Also linkable to FORTRAN-80 or COBOL-80 code modules ..... **$350/$25**

☐ **FORTRAN-80** — ANSI 66 (except for COMPLEX) plus Ⓛ many extensions. Includes relocatable object com- Ⓜ piler, linking loader, library with manager. Also includes MACRO-80 (see below) ..... **$425/$25**

☐ **COBOL-80** — Level 1 ANSI '74 standard COBOL plus Ⓛ most of Level 2. Full sequential, relative, and In- Ⓜ dexed file support with variable file names. STRING, UNSTRING, COMPUTE, VARYING/UNTIL, EXTEND, CALL, COPY, SEARCH, 3-dimensional arrays, compound and abbreviated conditions, nested IF. Powerful interactive screen-handling extensions. Includes compatible assembler, linking loader, and relocatable library manager as described under MACRO-80 ..... **$700/$25**

☐ **MACRO-80** — 8080/Z80 Macro Assembler. Intel and Ⓛ Zilog mnemonics supported. Relocatable linkable Ⓜ output. Loader, Library Manager and Cross Reference List utilities included ..... **$149/$15**

☐ **XMACRO-86** — 8086 cross assembler. All Macro and Ⓛ utility features of MACRO-80 package. Mnemonics slightly modified from Intel ASM86. Compatibility data sheet available ..... **$275/$25**

☐ **EDIT-80** — Very fast random access text editor for text Ⓛ with or without line numbers. Global and intra-line commands supported. File compare utility included. ..... **$89/$15**

☐ **PASCAL/M*** — Compiler generates P code from ex- Ⓘ tended language, implementation of standard PASCAL. Supports overlay structure through additional procedure calls and the SEGMENT procedure type. Provides convenient string handling capability with the added variable type STRING. Untyped files allow memory image I/O. Requires 56K CP/M .... **$150/$20**

Price Slashed

☐ **PASCAL/Z** — Z80 native code PASCAL compiler. Pro- Ⓘ duces optimized, ROMable re-entrant code. All interfacing to CP/M is through the support library. The package includes compiler, Microsoft Compatible relocating assembler and linker, and source for all library modules. Variant records, strings and direct I/O are supported. Requires 56K CP/M and Z80 CPU. ..... **$395/$25**

☐ **PASCAL/MT** — Subset of standard PASCAL. Gener- Ⓜ ates ROMable 8080 machine code. Symbolic debug- Ⓧ ger included. Supports interrupt procedures, CP/M file I/O and assembly language interface. Real variables can be BCD, software floating point, or AMD 9511 hardware floating point. Version 3 includes Enumeration and Record data types. Manual explains BASIC to PASCAL conversion. Source for the runtime package requires Digital Research's MAC. Requires 32K ..... **$250/$30**

New Version

New Features

☐ **ALGOL-60**—Powerful block-structured language compiler featuring economical run-time dynamic allocation of memory. Very compact (24K total RAM) system implementing almost all Algol 60 report features plus many powerful extensions including string handling direct disk address I/O etc. Requires Z80 CPU ..... **$199/$20**

☐ **CBASIC-2** Disk Extended BASIC — Non-interactive Ⓜ BASIC with pseudo-code compiler and run-time interpreter. Supports full file control, chaining, integer and extended precision variables, etc. ..... **$120/$15**

MICRO FOCUS

☐ **STANDARD CIS COBOL** — ANSI '74 COBOL stand- Ⓛ ard compiler fully validated by U.S. Navy tests to ANSI level 1. Supports many features to level 2 including dynamic loading of COBOL modules and a full *ISAM file facility. Also, program segmentation, interactive debug and powerful interactive extensions to support protected and unprotected CRT screen formatting from COBOL programs used with any dumb terminal ..... **$850/$50**

☐ **FORMS 2** — CRT screen editor. Output is COBOL data Ⓛ descriptions for copying into CIS COBOL programs. Automatically creates a query and update program of indexed files using CRT protected and unprotected screen formats. No programming experience needed. Output program directly compiled by CIS COBOL (standard) ..... **$200/$20**

Tasty lower prices!

EIDOS SYSTEMS

☐ **KISS** — Keyed Index Sequential Search. Offers com- Ⓛ plete Multi-Keyed Index Sequential and Direct Access file management. Includes built-in utility functions for 16 or 32 bit arithmetic, string/integer conversion and string compare. Delivered as a relocatable linkable module in Microsoft format for use with FORTRAN-80 or COBOL-80, etc. ..... **$335/$23**

Software with Manual / Manual Alone

☐ **KBASIC** — Microsoft Disk Extended BASIC with all Ⓛ KISS facilities, integrated by implementation of nine additional commands in language. Package includes KISS. REL as described above, and a sample mail list program ..... **$585/$45**
To licensed users of Microsoft BASIC-80 (MBASIC) ..... **$435/$45**

☐ **XYBASIC** Interactive Process Control BASIC — Full disk BASIC features plus unique commands to handle bytes, rotate and shift, and to test and set bits. Available in Integer, Extended and ROMable versions. Integer Disk or Integer ROMable ..... **$295/$25**
Extended Disk or Extended ROMable ..... **$395/$25**

☐ **BASIC UTILITY DISK** — Consists of: (1) CRUNCH-14 Ⓜ — Compacting utility to reduce the size and increase the speed of programs in Microsoft BASIC and TRS-80 BASIC. (2) DPFUN — Double precision subroutines for computing nineteen transcendental functions including square root, natural log, log base 10, sin, arc sin, hyperbolic sin, hyperbolic arc sin, etc. Furnished in source on diskette and documentation ... **$50/$35**

☐ **STRING/80** — Character string handling plus routines Ⓜ for direct CP/M BDOS calls from FORTRAN and other compatible Microsoft languages. The utility library contains routines that enable programs to chain to a COM file, retrieve command line parameters, and search file directories with full wild card facilities. Supplied as linkable modules in Microsoft format. ..... **$95/$20**

STRING/80 source code available separately **$295/n.a.**

☐ **THE STRING BIT** — FORTRAN character string han- dling. Routines to find, fill, pack, move, separate, concatenate and compare character strings. This package completely eliminates the problems associated with character string handling in FORTRAN. Supplied with source ..... **$65/$15**

☐ **VSORT** — Versatile sort/merge system for fixed length Ⓜ records with fixed or variable length fields. VSORT can be used as a stand-alone package or loaded and called as a subroutine from CBASIC-2. When used as a subroutine, VSORT maximizes the use of buffer space by saving the TPA on disk and restoring it on completion of sorting. Records may be up to 255 bytes long with a maximum of 5 fields. Upper/lower case translation and numeric fields supported. ..... **$175/$20**

NEW

☐ **CPM/374X** — Has full range of functions to create or re-name an IBM 3741 volume, display directory information and edit the data set contents. Provides full file transfer facilities between 3741 volume data sets and CP/M files ..... **$195/$10**

☐ **BSTAM** — Utility to link one computer to another also Ⓜ equipped with BSTAM. Allows file transfers at full data speed (no conversion to hex), with CRC block control check for very reliable error detection and automatic retry. We use it! It's great! Full wildcard expansion to send *.COM, etc. 9600 baud with wire. 300 baud with phone connection. **Both** ends need one. Standard and Ⓜ versions can talk to one another. ..... **$150/$5**

☐ **WHATSIT?*** Interactive data-base system using as- sociative tags to retrieve information by subject. Hashing and random access used for fast response. Requires CBASIC-2 ..... **$175/$25**

☐ **SELECTOR III-C2** — Data Base Processor to create Ⓜ and maintain multi Key data bases. Prints formatted † sorted reports with numerical summaries or mailing labels. Comes with sample applications, including Sales Activity, Inventory, Payables, Receivables, Check Register, and Client/Patient Appointments, etc. Requires CBASIC-2. Supplied in source ... **$295/$20**

Lower Price

☐ **GLECTOR** — General Ledger option to SELECTOR III-C2. Interactive system provides for customized COA. Unique chart of transaction types insure proper double entry bookkeeping. Generates balance sheets, P&L statements and journals. Two year record allows for statement of changes in financial position report. Supplied in source. Requires SELECTOR III-C2, CBASIC-2 and 52K system ..... **$250/$25**

☐ **CBS** — Configurable Business System is a compre- Ⓜ hensive set of programs for defining custom data files and application systems without using programming language such as BASIC, FORTRAN, etc. Multiple key fields for each data file are supported. Set-up program customizes system to user's CRT and printer. Provides fast and easy interactive data entry and retrieval **with transaction processing.** Report generator program does complex calculations with stored and derived data, record selection with multiple criteria, and custom formats. Sample inventory and mailing list systems included. **No support language required** ..... **$295/$25**

NEW

Prices and specifications subject to change without notice.

Software with Manual / Manual Alone

MICRO DATA BASE SYSTEMS

☐ **HDBS** — Hierarchical Data Base System. CODASYL oriented with FILEs, SETs, RECORDs and ITEMs which are all user defined. ADD, DELETE, UPDATE, SEARCH, and TRAVERSE commands supported. SET ordering is sorted, FIFO, LIFO, next or prior. One to many set relationship supported. Read/Write protection at the FILE level. Supports FILEs which extend over multiple floppy or hard disk devices.

☐ **MDBS** — Micro Data Base System. Full network data base with all features of HDBS plus multi-level Read/Write protection for FILE, SET, RECORD and ITEM. Explicit representation of one to one, one to many, many to many, and many to one SET relationships. Supports multiple owner and multiple record types within SETs. HDBS files are fully compatible.

☐ **MDBS-DRS** — MDBS with Dynamic Restructuring System option which allows altering MDBS data bases when new ITEMs, RECORDs, or SETs are needed without changing existing data.

HDBS-Z80 version ..... **$250/$40**
MDBS-Z80 version ..... **$750/$40**
MDBS-DRS-Z80 version ..... **$850/$50**
8080 Version available at $75. extra.

When ordering, specify one of the languages listed below.

NOTE

HDBS and MDBS manuals purchased alone come without specific language interface manuals. Manuals are available for the following Microsoft languages: 1) MBASIC 4.51, 2) BASIC-80, 5.0, 3) Compiled BASIC-80 or FORTRAN-80, 4) COBOL-80, 5) MACRO-80 ..... **$NA/$10**

all Micropro prices are discounted!

MICROPRO

☐ **SUPER-SORT I** — Sort, merge, extract utility as ab- Ⓛ solute executable program or linkable module in Microsoft format. Sorts fixed or variable records with data in binary, BCD, Packed Decimal, EBCDIC, ASCII, floating & fixed point, exponential, field justified, etc. Even variable number of fields per record! . **$225/$25**

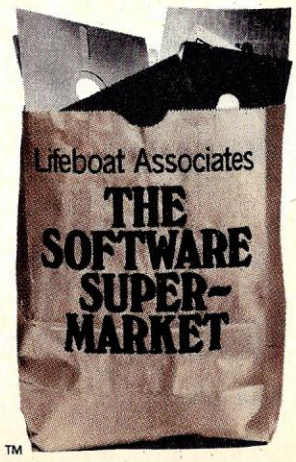
☐ **SUPER-SORT II** — Above available as absolute pro- Ⓛ gram only ..... **$175/$25**

☐ **SUPER-SORT III** — As II without SELECT/EXCLUDE Ⓛ ..... **$125/$25**

☐ **WORD-STAR** — Menu driven visual word processing Ⓛ system for use with standard terminals. Text formatting performed on screen. Facilities for text paginate, page number, justify, center and underscore. User can print one document while simultaneously editing a second. Edit facilities include global search and replace, Read/Write to other text files, block move, etc. Requires CRT terminal with addressable cursor positioning ..... **$445/$40**

☐ **WORD-STAR Customization Notes** — For sophisticated users who do not have one of the many standard terminal or printer configurations in the distribution version of WORD-STAR ..... **NA/$95**

☐ **WORD-MASTER** Text Editor — In one mode has super- Ⓛ set of CP/M's ED commands including global searching and replacing, forwards and backwards in file in video mode, provides full screen editor for users with serial addressable-cursor terminal ..... **$125/$25**



Everything on #12 runs on 64K TRS-80 Model II

Lifeboat Associates, 2248 Broadway, N.Y., N.Y. 10024 **(212) 580-0082** Telex: 220501 TM

Software with Manual / Manual Alone

☐ **POLYVUE/80** — Full screen editor for any CRT with Ⓜ XY cursor positioning. Includes vertical and horizontal scrolling, interactive search and replace, automatic text wrap around for word processing, operations for manipulating blocks of text, and comprehensive 70 page manual .....$135/$15

☐ **POLYTEXT/80** — Text formatter for word processing Ⓜ applications. Justifies and paginates source text files. Will generate form letters with custom fields and conditional processing. Support for Daisy Wheel printers includes variable pitch justification and motion optimization .....$85/$15

☐ **TEXTWRITER III** — Text formatter to justify and pagi- Ⓜ nate letters and other documents. Special features include insertion of text during execution from other disk files or console, permitting recipe documents to be created from linked fragments on other files. Has facilities for sorted index, table of contents and footnote insertions. Ideal for contracts, manuals, etc. Now compatible with Electric Pencil* prepared files. .....$125/$20

Now-applications software for Microsoft's BASIC interpreter.

PEACHTREE SOFTWARE

☐ **GENERAL LEDGER** — Records details of all financial Ⓛ transactions. Generates a balance sheet and an in- † come statement. Flexible and adaptable design for both small businesses and firms performing client writeup services. Produces reports as follows: Trial Balance, Transaction Registers, Balance Sheet, Prior Year Comparative Balance Sheet, Income Statement, Prior Year Comparative Income Statement and Department Income Statements. Interactive with other PEACHTREE accounting packages. Supplied in source code for Microsoft BASIC .....$990/$30

☐ **ACCOUNTS PAYABLE** — Tracks current and aged Ⓛ payables and incorporates a check writing feature. † Maintains a complete vendor file with information on purchase orders and discount terms as well as active account status. Produces reports as follows: Open Voucher Report, Accounts Payable Aging Report and Cash Requirements. Provides input to PEACHTREE General Ledger. Supplied in source code for Microsoft. BASIC .....$990/$30

☐ **ACCOUNTS RECEIVABLE** — Generates invoice regis- Ⓛ ter and complete monthly statements. Tracks current † and aged receivables. Maintains customer file including credit information and account status. The current status of any customer account is instantly available. Produces reports as follows: Aged Accounts Receivable, Invoice Register, Payment and Adjustment Register and Customer Account Status Report. Provides input to PEACHTREE General Ledger. Supplied in source code for Microsoft BASIC ..$990/$30

☐ **PAYROLL** — Prepares payroll for hourly, salaried and Ⓛ commissioned employees. Generates monthly, quar- † terly and annual returns. Prepares employee W-2's. Includes tables for federal withholding and FICA as well as withholding for all 50 states plus up to 20 cities from pre-computed or user generated tables. Will print checks, Payroll Register, Monthly Summary and Unemployment Tax Report. Provides input to PEACHTREE General Ledger. Supplied in source code for Microsoft BASIC .....$990/$30

☐ **INVENTORY** — Maintains detailed information on Ⓛ each inventory item including part number, descrip- † tion, unit of measure, vendor and reorder data, item activity and complete information on current item costs, pricing and sales. Produces reports as follows: Physical Inventory Worksheet, Inventory Price List, Departmental Summary Report, Inventory Status Report, The Reorder Report and the Period-to-Date and Year-to-Date reports. Supplied in source code for Microsoft BASIC .....$1,190/$30

☐ **MAILING ADDRESS** — Keeps track of name and ad- Ⓛ dress information and allows the selective printing of † this information in the form of mailing lists or address labels. Allows the user to tailor the system to his own particular requirements. User-defined format and print-out system uses a special format file which tells programs how to print the mailing list or address labels. Standard format files are included with system. Automatic sorting of data uses indexed file management routines which allow the name and address information to be sequentially retrieved and printed without file sorting. Supplied in source code for Microsoft BASIC .....$790/$30

GRAHAM-DORIAN SOFTWARE SYSTEMS

☐ **GENERAL LEDGER** — An on-line system; no batch- Ⓛ ing is required. Entries to other GRAHAM-DORIAN Ⓜ accounting packages are automatically posted. User † establishes customized C.O.A. Provides transaction register, record of journal entries, trial balances and monthly closings. Keeps 14 month history and provides comparison of current year with previous year. Requires CBASIC-2. Supplied in source ...$995/$35

☐ **ACCOUNTS PAYABLE** — Maintains vendor list and Ⓛ check register. Performs cash flow analysis. Flexible Ⓜ — writes checks to specific vendor for certain in- † voices or can make partial payments. Automatically posts to GRAHAM-DORIAN General Ledger or runs as stand alone system. Requires CBASIC-2. Supplied in source .....$995/$35

☐ **ACCOUNTS RECEIVABLE** — Creates trial balance re- Ⓛ ports, prepares statements, ages accounts and rec- Ⓜ ords invoices. Provides complete information describ- † ing customer payment activity. Receipts can be posted to different ledger accounts. Entries automatically update GRAHAM-DORIAN General Ledger or runs as stand alone system. Requires CBASIC-2. Supplied in source .....$995/$35

☐ **PAYROLL SYSTEM** — Maintains employee master file. Ⓛ Computes payroll withholding for FICA, Federal and Ⓜ State taxes. Prints payroll register, checks, quarterly † reports and W-2 forms. Can generate ad hoc reports and employee form letters with mail labels. Requires CBASIC-2. Supplied in source .....$590/$35

☐ **INVENTORY SYSTEM** — Captures stock levels, costs, Ⓛ sources, sales, ages, turnover, markup, etc. Trans- Ⓜ action information may be entered for reporting by † salesman, type of sale, date of sale, etc. Reports available both for accounting and decision making. Requires CBASIC-2. Supplied in source ...$590/$35

☐ **JOB COSTING** — Designed for general contractors. Ⓛ To be used interactively with other GRAHAM-DORIAN Ⓜ accounting packages for tracking and analysing ex- † penses. User establishes customized cost categories and job phases. Permits comparison of actual versus estimated costs. Automatically updates GRAHAM-DORIAN General Ledger or runs as stand alone system. Requires CBASIC-2. Supplied in source $995/$35

Orders must specify disk systems and formats: e.g. North Star single, double or quad density, IBM single or 2D/256, Altair, Helios II, Micropolis Mod I or II, 5¼" soft sector (Micro iCOM/SD Systems Dynabyte), etc.

Manual cost applicable against price of subsequent software purchase.

The sale of each proprietary software package conveys a license for use on one system only.

Prices F.O.B. New York. Shipping, handling and C.O.D. charges extra.

VISA master charge

Software with Manual / Manual Alone

☐ **APARTMENT MANAGEMENT SYSTEM** — Financial Ⓛ management system for receipts and security de- Ⓜ posits of apartment projects. Captures data on va- † cancies, revenues, etc. for annual trend analysis. Daily report shows late rents, vacancy notices, vacancies, income lost through vacancies, etc. Requires CBASIC-2. Supplied in source .....$590/$35

☐ **CASH REGISTER** — Maintains files on daily sales. Ⓛ Files data by sales person and item. Tracks sales, Ⓜ over-rings, refunds, payouts and total net deposits. † Requires CBASIC-2. Supplied in source ...$590/$35

☐ **POSTMASTER** — A comprehensive package for mail Ⓜ list maintenance that is completely menu driven. Features include keyed record extraction and label production. A form letter program is included which provides neat letters on single sheet or continuous forms. Compatible with NAD files. Requires CBASIC-2 .....$150/$15

New Features

STRUCTURED SYSTEMS GROUP

☐ **GENERAL LEDGER** — Interactive and flexible system † providing proof and report outputs. Customization of COA created interactively. Multiple branch accounting centers. Extensive checking performed at data entry for proof, COA correctness, etc. Journal entries may be batched prior to posting. Closing procedure automatically backs up input files. Now includes Statement of Changes in Financial Position. Requires CBASIC-2 .....$1250/$25

☐ **ACCOUNTS RECEIVABLE** — Open item system with † output for internal aged reports and customer-oriented statement and billing purposes. On-Line Enquiry permits information for Customer Service and Credit departments. Interface to General Ledger provided if both systems used. Requires CBASIC-2 .....$1250/$25

☐ **ACCOUNTS PAYABLE** — Provides aged statements † of accounts by vendor with check writing for selected invoices. Can be used alone or with General Ledger and/or with NAD. Requires CBASIC-2 ....$1250/$25

☐ **PAYROLL** — Flexible payroll system handles weekly, † bi-weekly, semi-monthly and monthly payroll periods. Tips, bonuses, re-imbursements, advances, sick pay, vacation pay, and compensation time are all part of the payroll records. Prints government required periodic reports and will post to multiple SSG General Ledger accounts. Requires CBASIC-2 and 54K of memory .....$1250/$25

☐ **INVENTORY CONTROL SYSTEM** — Performs control † functions of adding and depleting stock items, adding new items and deleting old items. Tracks quantity of items on hand, on order and back-ordered. Optional hard copy audit trail is available. Reports include Master Item List, Stock Activity, Stock Valuation and Re-order List. Requires CBASIC-2 $1250/$25

☐ **ANALYST** — Customized data entry and reporting sys- † tem. User specifies up to 75 data items per record. Interactive data entry, retrieval, and update facility makes information management easy. Sophisticated report generator provides customized reports using selected records with multiple level break-points for summarization. Requires CBASIC-2 .....$250/$15

☐ **LETTERIGHT** — Program to create, edit and type letters or other documents. Has facilities to enter, display, delete and move text, with good video screen presentation. Designed to integrate with NAD for form letter mailings. Requires CBASIC-2 ..$200/$25

☐ **NAD** Name and Address selection system — interac- tive mail list creation and maintenance program with output as full reports with reference data or restricted information for mail labels. Transfer system for extraction and transfer of selected records to create new files. Requires CBASIC-2 .....$100/$20

☐ **QSORT** — Fast sort/merge program for files with fixed record length, variable field length information. Up to five ascending or descending keys. Full back-up of input files created .....$100/$20

★★★★★★★

CONDIMENTS

☐ **HEAD CLEANING DISKETTE**—Cleans the drive Read/ Write head in 30 seconds. Diskette absorbs loose oxide particles, fingerprints, and other sub-micron particles that might hinder the performance of the drive head. Lasts at least 3 months with daily use. Specify 5" or 8".

NEW Single sided .....$20 each/$55 for 3
Double sided .....$25 each/$65 for 3

☐ **FLIPPY DISK KIT** — Template and instructions to modify single sided 5¼" diskettes for use of second side in single sided drives $12.50

☐ **FLOPPY SAVER** — Protection for center holes of 5" and 8" floppy disks. Only 1 needed per diskette. Kit contains centering post, pressure tool and tough 7 mil mylar reinforcing rings for 25 diskettes.

5", Kit $14.95
NEW 5", Rings only $7.95
8", Kit $16.95
8", Rings only $8.95

☐ **PASCAL USER MANUAL AND REPORT** — By Jensen and Wirth. The standard textbook on the language. Recommended for use by Pascal/Z, Pascal/M and Pascal/MT users $10

☐ **THE C PROGRAMMING LANGUAGE** — By Kernighan and Ritchie. The standard textbook on the language. Recommended for use by BDS C, tiny C, and Whitesmiths C users $12

☐ **STRUCTURED MICROPROCESSOR PROGRAMMING** — By the authors of SMAL/80. Covers structured programming, the 8080/8085 instruction set and the NEW SMAL/80 language $20.00

☐ **ACCOUNTS PAYABLE & ACCOUNTS RECEIVABLE— CBASIC** — By Osborne/McGraw-Hill $20

NEW ☐ **GENERAL LEDGER—CBASIC** — By Osborne/McGraw-Hill $20

★★★★★★★

Hearty Appetite.

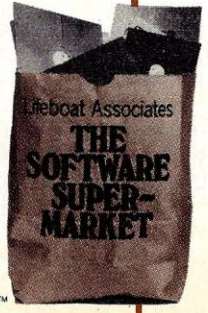
*CP/M and MP/M are trademarks of Digital Research.
Z80 is a trademark of Zilog, Inc.
UNIX is a trademark of Bell Laboratories.
WHATSIT? is a trademark of Computer Headware.
Electric Pencil is a trademark of Michael Shrayer Software.
TRS-80 is a trademark of Tandy Corp.
Pascal/M is a trademark of Sorcim.

†Recommended system configuration consists of 48K CP/M, 2 full size disk drives, 24 x 80 CRT and 132 column printer.

Ⓜ Modified version available for use with CP/M as implemented on Heath and TRS-80 Model I computers.

Ⓛ User license agreement for this product must be signed and returned to Lifeboat Associates before shipment may be made.

ⓘ ⓧ This product Includes/eXcludes the language manual recommended in Condiments.



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Safe, cont'd...

don't understand what computers are all about." Every computer has weaknesses, just as every manual bookkeeping system contains potential for fraud. But the weaknesses of paper and pencil are more familiar to businessmen new to the rapidly changing computer industry. Giants like IBM and Honeywell spend heavily on security, but manufacturers and salesmen of small systems educate customers inadequately about limitations. Robert Jacobson observes that "the manufacturer is not going to grab him by the lapels and look him in the eye" to warn the customer about abuse. "The manufacturer wants to sell him that computer and he's not going to stress any potential difficulties."

Small business systems are particularly vulnerable to embezzlement and fraud.

Small business systems are particularly vulnerable to embezzlement and fraud, Jacobson tells us, because supervisors and owners seem "unsophisticated in computer technology." Even when the owner or manager understands the system, the operator might know it better. Moreover, any employee might fool with a micro system as small businesses are unlikely to designate a computer room. Jacobson adds that "the entire data processing department will be one person who does the programming and the data entry and the operations. When you don't have separation of duties and reasonable checks and balances, you're in for trouble."

Micro systems often lack rudimentary hardware or software security. Among inexpensive off-the-shelf systems, for example, the Commodore PET has no procedures to limit access to disk files. The Apple II disk operating system allows non-printing and therefore secret control characters in file names, but data so protected are completely inaccessible to users who may need to read a file, even if they should not be permitted to alter its contents. The Radio Shack TRS-80 disk operating system uses a two-level password procedure. A manager can have one password, granting full access to a file, and an operator another, allowing limited privileges, possibly only the ability to read a file. However, several software houses offer compatible operating systems which ignore the password requirement; a thief can always supply his own system diskette. More expensive computers provide a little more security. An operating system for Cromem-

Safe, cont'd . . .

co hardware gives read-protect and write-protect options for disk files, but micro security remains a low wall.

Passwords are frequently abused and unsafe. Many consultants have urged clients to discourage employees from saving passwords on paper where anyone may find them. Some computers users assign unimaginative passwords like "password" or "Sesame." Still others use their names, addresses, initials or other obvious combinations of characters. A potential abuser can discover them easily.

Theft of storage media is a severe problem for small computers. Diskettes and tapes are easy to steal or borrow and backup procedures enable operators to copy sensitive files undetected. Some businessmen fear hiring a computer operator who might have a machine identical to that of his employer. Programs and data files are entirely insecure if an operator can take them home and leisurely change them to suit his needs.

Languages open additional security breaches. Many small systems rely on interpreted Basic programs, easy to write and maintain, also to alter and abuse. A novice programmer can pull apart a Basic program, add a few instructions and defraud a computer owner with modified coding. A clever thief will hide offending instructions or order the computer never to print them in a normal program listing. There is a way to accomplish such stealth on a simple machine like the TRS-80. Even compiled programs, possibly in Pascal, Cobol or Fortran, are insecure, especially if the operator gets the source code, modifies and recompiles it, then returns it to original form. Hardly anyone would discover a fraud so concealed.

Physical security is the most obvious. Even if a separate room is not feasible, management can place the computer where supervisors will constantly see it.

Care and knowledge bring small computer security. Before installing a computer system, assume it will operate in a hostile environment. Computerized data processing is considerably less secure than manual procedures if the owner is unaware of inherent weaknesses and simple precautions to overcome them. There are a few hurdles to clear, but small business computer owners can afford reasonable security, possibly greater than in conventional systems.

Physical security is the most obvious. Even if a separate room is not feasible, management can place the computer where supervisors will constantly see it. If locking the computer away is impractical, lock up disks, tapes, program listings and other sensitive data. There are few reasons why anyone other than a small business owner or his most trusted employee should have unrestricted access to floppy disks.

Software design should include security provisions. Even though microcomputer operators replace disks easily, as the drives are at the console, the operating system should require a secure sign-on procedure. In the Apple II or TRS-80, for example, an automatic program run on power-up is possible. There are ways to defeat it, but the operator will not necessarily know them. A program which provides security without expensive equipment modifications, for example, will both hang the computer in a loop and disable other sensitive programs on all drives until it receives a correct password. A similar verification procedure for every program run or file opened will help keep data secure. Any program which modifies sensitive data should be especially protective of files.

Self-policing procedures built into programs aid security. If the computer requests a password and repeatedly gets incorrect answers, the program should cease operations and lock out efforts to reset the computer until a supervisor intervenes. Software which logs every file access increases accountability of operators for their actions. Programs might check for reasonable input. Attempts to credit a receivable account with payments exceeding its debits, for instance, should generate a log entry or a supervisor call.

Few software security techniques mean anything in interpreted Basic programs. To implement security the system owner needs a programmer who works in machine or assembly language or in a compiled high level language like Pascal or Cobol. If a businessman has programming skills, he may wish to write his own software, or he might prefer to hire a consulting service. Under no circumstances should a businessman hire a programmer-operator. Operators must never see the original source code or documentation. Allowing your computer operator to program is like asking your bookkeeper to audit. Consulting services cost more than in-house programming, but the added security and expertise justify considerable investment. As Citibank's M. Blake Greenlee states it, "The ideal situation is that when the program is finished, you never see the programmer again."

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Safe, cont'd...

cover assets if someone breaches computer security, and businessmen should consult with their agents to review coverage. Good auditing helps, too, but knowledge makes the individual businessman a human deterrent to computer crime. Those who educate

Allowing your computer operator to program is like asking your bookkeeper to audit.

themselves about computer limits and abilities take the most effective step toward computer security, one which leads to all the others. Many universities include computer studies among requirements for business degrees. Harvard has announced that all undergraduates must achieve computer literacy before they will graduate. Despite security hazards, electronic data processing can be safer and cheaper than manual techniques. Businessmen considering purchase of a computer owe themselves courses in computer science that they might hope to be as skilled as potential embezzlers. Whatever diminishes the mystery surrounding computers will help prevent financial losses from computer abuse. □

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CIRCLE 209 ON READER SERVICE CARD

Con man flees with pockets full of gold

If the Santa Claus who visited you was a snappy dresser, chomped on hot dogs, jingled with gold coins instead of bells and didn't deliver the gift you asked for, Montreal police want to hear from you.

The city's fraud squad is still unsure of the identity of the con artist suspected of bilking $500,000 from about 8,000 unsuspecting Canadians who answered newspaper advertisements for a non-existent $62.45 computerized chess and backgammon game.

But the man appears to have staged his operation using the name Brian Gould, police said.

"I've never seen such a clean operation," said Det.-Sgt. Gilles Gagnon, a 12-year veteran of the Montreal police commercial fraud section and one of two investigators on the suspect's trail.

"This is as close as a criminal can come to committing the perfect crime."

The suspect was last reported in Vancouver, possibly bound for Taiwan.

The con man, who is believed to have hot-footed out of Montreal around Nov. 26 toting $135,000 in gold, by all indications ran a finely-tuned operation. Investigators pieced together this picture:

Dapper, English-speaking and a heavy smoker, he went into the registry office at the Montreal courthouse July 9, a month after renting himself a west-end office.

After paying $5 and making a solemn declaration that he was a "businessman . . . intending (to sell) electronic components at 5253 Decarie Blvd.," the man walked out with an official document declaring him a bona fide businessman. No one at the court had asked for any identification, police said.

Next, the con artist visited a metal firm and paid cash for two wafer-thin plates made to resemble the high-priced electronic chess games being advertised everywhere.

The man said he needed the model in a hurry because he was launching an ad campaign right away and couldn't wait for a prototype of the computer to arrive from Japan through Houston, Texas.

He then paid $5,000 to an ad agency, assuring him both a professional-looking newspaper campaign and a respectable credit rating, and got approval from Visa to sell the games through its credit card system.

Finally, he opened an account at a Toronto-Dominion bank branch far north of his office — probably aware that it was one of the few in the district without security cameras.

The first ads for the "Danwarth six-level backgammon and chess computer" appeared in three Montreal dailies in late October, and the orders came pouring in.

The man then placed more ads in other major newspapers across Canada, and hired a Girl Friday from an office employment agency to help handle the order forms and count the money.

"He was a nice enough guy, but a little weird," said secretary Janet McIntosh, recalling he never left the office, ate hot dogs constantly and "wore surgical gloves so as not to get his hands dirty while handling the order forms."

The orders had been mailed — with cheques, money orders or credit card numbers — to a Yonge Street address in Toronto, then relayed to Montreal by courier companies.

About 1,000 customers also ordered an optional non-existent carrying case for the non-existent game. Price: $22.50.

On Nov. 23, the trickster prepared his getaway.

He sent a courier to the bank to certify a $125,000 cheque, then downtown to make a purchase with it — 257 gold Krugerrand coins.

The courier wasn't impressed with the errand, complaining to Gould that his outfit "wasn't Brink's." Next day, the man sent another courier for another four coins plus two gold wafers.

Finally, he called in a maintenance company to scrub up the office. They did such a good job that there wasn't a fingerprint left when investigators were alerted three days after the con artist disappeared.

Just before leaving, police said, he called a courier to have a $216 cheque certified and then to make a purchase for him at a downtown store — an electronic chess game.

Reprinted from Edmonton Journal.

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By Roger Wagner

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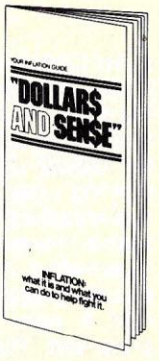

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Sargon's creators — the Spraklens

The Sargon Chronicle

Theodore H. Ehara

Creative Computing: How many hours do you put into Sargon?

Dan Spraklen: A DAY? (Chuckles) A lot!

Kathe Spraklen: Sixteen.

Dan Spraklen: Sometimes ten — sixteen hours.

Kathe Spraklen: He eats and sleeps.

Dan Spraklen: You know, it's something I like to do, so I do it a lot.

If you were standing in the tournament hall of the 9th Annual Tournament for the North American Computer Chess Championship, you might have seen Dan Spraklen walking into the hall with a Jupiter computer in his arms. This electronic box would soon be loaded with a tough little chess-playing program known as Sargon II that was developed by Dan and his wife Kathe. However, if you had even a little knowledge of computer chess, you would realize that portable computers had a very poor chance against programs that were run on multi-million dollar machines. The speed of a larger computer gave it a distinct advantage in brute force (i.e., the ability to look ahead). Since a six-fold increase in speed gives the program an extra half move to look at, the more successful programs were always run on the fastest machines available.

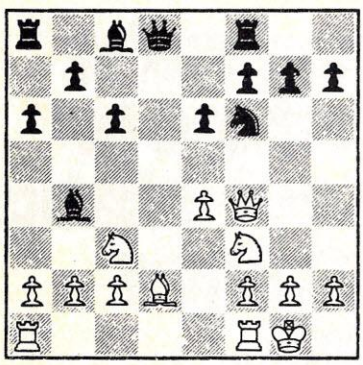

FIGURE 1

Kathe (back to camera) and Dan Spraklen (far right) listen to David Cahlander (squatting) from Chess 4.9, as David Kittinger of Mychess waits for his program to move during the recent North American Computer Chess Championship. Sargon 2.5 is contained beneath the chess board and indicates its moves by LED lights on the board.

It was no laughing matter when Sargon II found itself matched against AWIT.

Perhaps an observer would have thought that Sargon would be better off playing in a microcomputer tournament, like the 1st San Jose Micro-Tournament, where computers were divided up into three classes (8K or greater memory, less than 8K and Basic programs). However, the four month old Sargon I program had won all of its five games to win that tournament. Now the Spraklens were looking for stronger competition.

They would find that competition at the North American Computer Chess Championship. While the San Jose tournament had computers ranging from $6,000 to a home-made collection of circuits priced at $85, the 9th NACCC had the real big boys, computers priced in the millions, air-conditioned, bolted to the floor monsters that made moves by phone to terminals at the tournament site. Yes, the Spraklens had found strong competition for Sargon II.

Sargon — the name for an ancient king in Assyria.

"There were actually two Sargons," related Dan. "One was Sargon II. He was the king of Assyria, about 700 B.C. Sargon I was the king of Akkad, which was ancient Sumaria, about 2,000 B.C."

The name itself means 'Declared King' since Sargon I was not himself born king, but was crowned in adulthood," said Kathe.

"Of course we didn't know this, we knew that the name had ancient historical connotations, but we picked it because it sounded suave." She added with a laugh, "Then we had to go back and learn about it, since everybody kept asking us."

However, it was no laughing matter when Sargon II found itself

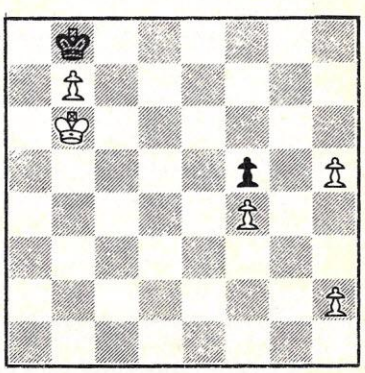

FIGURE 2

Theodore H. Ehara, 1004 Hinman Ave., Evanston, IL 60202.

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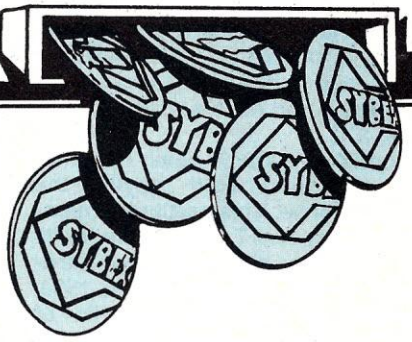

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Chronicle, cont'd...

matched against AWIT. AWIT was running on an Amdahl 470 V6 computer that was located in the computer room at the University of Alberta. One of the "big boys." Some of the tournament spectators felt that this obvious mismatch would be quickly conceded to AWIT.

Three minutes to figure out the pitfall in the position or else Sargon II would lose the game by exceeding the time limit.

"The secret to the successful chess program," reflected Dan, "is putting this chess knowledge and combining it with brute force. You have to look ahead and you have to use knowledge while you're doing that. It's an integrated approach."

"A lot of people who are knowledge-based advocates," stated Kathe, "are, in some sense, against using a look-ahead. Whereas I feel that you might as well use a look-ahead, since it will refine anything you know. Why limit yourself arbitrarily?"

The difference between Sargon II and AWIT could be summed up in one word — staggering. The AWIT program was ten years old compared to Sargon's one. The Amdahl used a high-level language, ALGOL-W. The Wavemate Jupiter was using a primitive dialect of assembly language. Add in the difference in speed and memory capacity that a $5,000,000 computer would have against a $1,500 computer and you might understand why microcomputers could have a rough time in the NACCC.

Choosing a king's pawn opening, Sargon II found itself playing the Silician Defense. This particular opening chosen by AWIT was known for its sharp struggle since Polerio introduced it to the chess world in 1564. According to the Encyclopedia of Chess Openings, a standard reference among tournament players, AWIT could easily have equalized the position on the third move (3. ..., NQb3). AWIT did and the battle raged back and forth until the resulting end-game (see Table 1) was reached.

Although the winning technique might seem simple to a human chess player, computers were notorious for their sloppy end-game play. Basically, this was because of the difficulty in programming the concepts of the end-game, where different values are placed on pieces and positions. Furthermore, Sargon II had three minutes to make time-control. Three minutes to figure out the pitfall in the position or else Sargon II would lose the game by exceeding the time limit. Using half of its alloted time, Sargon II came up with the correct move and proceeded to win against AWIT.

Sargon II —	AWIT		
		33. N-B4+	K-N4
		34. N×R	B×P
1. P-K4	P-QB4	35. N×P	B×BP
2. P-Q4	P×P	36. N×P	B-N6
3. Q×P	N-QB3	37. N-B5	B-Q4
4. Q-K3	N-B3	38. P-KN3	B-B6
5. N-KB3	P-K3	39. N-N3	P-N5
6. N-B3	B-N5	40. N-Q4	B-K5
7. B-N5	P-QR3	41. P-B3	B-N2
8. B×N	QP×B	42. K-B2	P-R3
9. B-Q2	N-N5	43. K-K3	B-Q4
10. Q-B4	N-B3	44. N-B2	P-N6
11. 0-0	0-0 (See Fig. 1)	45. N-Q4	K-N3
12. QR-Q1	P-QN4	46. K-Q3	K-R2
13. B-K3	Q-R4	47. P-B4	K-N1
14. B-Q4	B×N	48. K-B3	K-N2
15. B×B	Q×P	49. N×P	B×N
16. B×N	P×B	50. K×B	K-B3
17. Q×P	Q-B5	51. K-B4	K-K2
18. Q-N5+	K-R1	52. P-QN4	K-Q2
19. Q-B6+	K-N1	53. K-Q5	P-R4
20. Q-N5+	K-R1	54. P-N5	K-B2
21. R-Q8	R×R	55. K-B5	K-N2
22. Q-B6+	K-N1	56. P-N6	K-N1
23. Q-N5+	K-B1	57. K-B6	K-B1
24. Q×R+	K-N2	58. P-N7+	K-N1
25. Q-N5+	K-B1	59. K-N6	P-R5
26. Q-Q8+	K-N2	60. P×P	P-B3
27. Q-Q4+	Q×Q	61. P-R5	P-B4 (See Fig. 2)
28. N×Q	B-N2	62. K-B6	K-R2
29. R-K1	K-N3	63. K-B7	K-R3
30. R-K3	R-Q1	64. P-N8=Q	K-R4
31. R-Q3	P-QB4	65. Q-N3	K-R3
32. N×KP	R×R	66. Q-R4 mate	

TABLE 1.

When asked later about their feelings on the Sargon II - AWIT game, Kathe replied, "It was kind of the high point in our lives." She laughed and continued, "It made the hard work worth it."

Although Dan and Kathe originally placed Sargon II at the 1500 level (Class C tournament strength) Sargon played five exhibition games under tournament conditions at the Paul Masson Open last July. The program ended its five games with a 3½ - 1½ result, giving it a provisional rating based on the games at 1640 (low Class B).

However, there has been a report of Sargon playing a Class A player who, according to rumor, played weaker than his rating. Perhaps this human was simply "psyched out" at the thought of playing a computer, or maybe he heard about what Sargon did to AWIT. □

Sargon I is available for TRS-80 (Level II) and Apple II computers in cassette form. If you'd rather program it yourself, you can buy **Sargon** written by Dan and Kathe Spraklen. Between moves, you might like to take a look at **Introduction to 8080 and Z-80 Assembly Language Programming** by Kathe Spraklen.

Sargon II is also available in cassette form for TRS-80 (Level II), Apple II and will soon be available for CP/M, SORCERER and Pet. Both books and tapes are available from Hayden Books.

If you don't have a computer (?) you can still play against Sargon II. Boris, a chess-playing processor made by Chafitz Inc., will be incorporating the Spraklen's programming into their newer models. Working along with Larry Atkin and David Slate, creators of Chess 5.0 — the current World Computer Chess Champion, the Spraklens are developing the recent models of Boris that will be sold this fall.

With the recruitment of the Spraklens to Chafitz's staff, the company has announced it plans to sign-up Boris for the next North American Computer Chess Championship.

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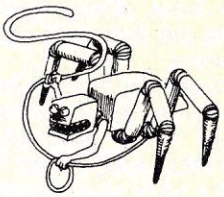
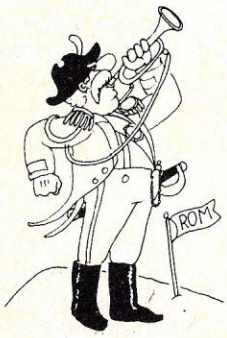
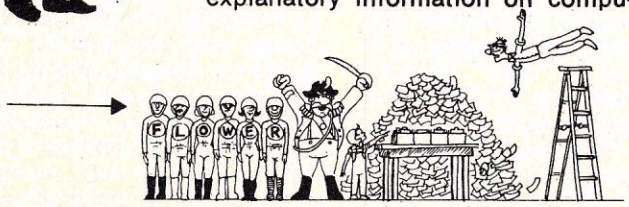
CIRCLE 135 ON READER SERVICE CARD

Katie and the Computer





Fred D'Ignazio and Stan Gilliam have created a delightful picture book adventure that explains how a computer works to a child. Katie "falls" into the imaginary land of Cybernia inside her Daddy's home computer. Her journey parallels the path of a simple command through the stages of processing in a computer, thus explaining the fundamentals of computer operation to 4 to 10 year olds. Supplemental explanatory information on computers, bytes, hardware and software is contained in the front and back end papers.



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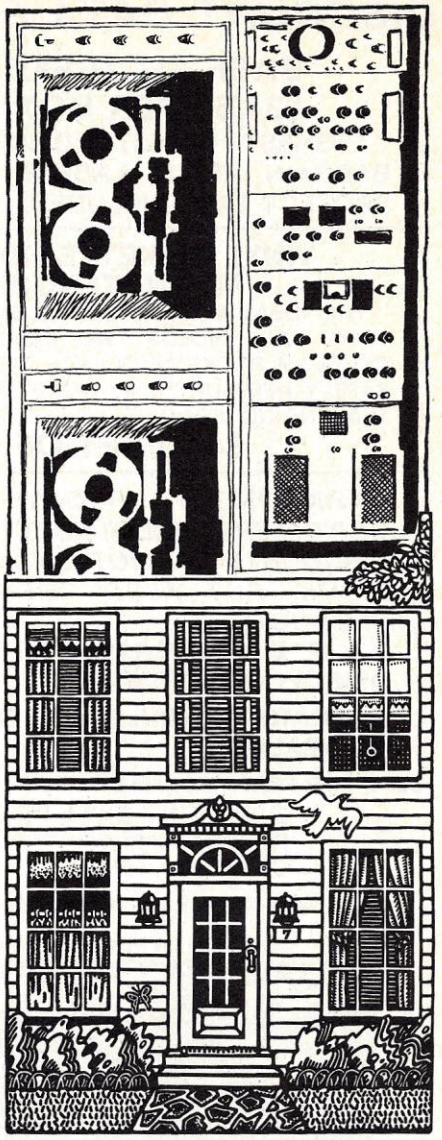
Written by Fred D'Ignazio and illustrated in full color by Stan Gilliam. 42 pages, casebound, $6.95. (12A)

A t-shirt with the Program Bug is available in a deep purple design on a beige shirt. Adult size S,M,L, XL. Children's size S,M,L. $5.00.

To order this book, use form on page 191 or order card opposite back cover.

"So He Says He's Going To Get A Home Computer!"

W. A. Stonelake



The man you love is going to be spending more time at home soon, and it just might drive you crazy.

The home computer revolution is sweeping across the country faster than the hula hoop, and more men and women are succumbing to its charms. Men have always been enamored of mechanical things: cars, power mowers and, now, this strange keyboard and monitor system which teach him how to add and do other things he already knew how to do. Anthropologists will tell you that Woman, on the other hand, is into earthier things: ocean tides, phases of the moon, and how to get the home computer out of her home.

Now that I am an old hand at dealing with a Home Computer User (HCU), I can pass along whatever knowledge and advice I have picked up. We have even reached a truce of sorts in our house: Barry promises to turn off the computer by midnight and I vow never to tapdance on the ceiling...

Here is a brief synopsis of the various stages you can expect to experience now that he has announced that he's going to get a home computer.

The Home Computer Arrives

The Home Computer User will come home one day with a little TV monitor, a typewriter keyboard and a cassette recorder. He will be utterly entranced by his new purchases so don't expect to see him for about four hours; he will be connecting all the wires and reading the manual. Once he is well underway with various simple programs, he will yell every five minutes, "Honey! Come here and see what this thing can *do!*" After the first eight or ten trips to watch the computer print out its name, your husband's name and your name, your smile will wear thin and your "oohs" and "aahs" will be markedly less enthusiastic.

You will lovingly gaze at the back of your HCU's head for hours, listening to his funny coos of amazement, his joyous shrieks of accomplishment, and his heart-rendering sobs of disappointment when his program bombs out and he can't locate the "bug." Out of sheer self-defense, you will encourage him to translate some of this unfamiliar jargon and you'll probably forget all of it within half an hour.

The *clever* HCU will realize that, in order for him to safely enjoy his new hobby, he should get you interested in it, too. Then you will be more tolerant of it. Let me warn you that learning how to program a computer from someone you love is only slightly less dangerous than having them teach you to drive.

Learning how to program a computer from someone you love is only slightly less dangerous than having them teach you to drive.

Now, if you should discover that you, too, are hopelessly caught up in this new world of "List," "Break," "Enter," and "Random Access Memory," then there's no problem. If you do not, however, care about whether or not the computer's interface can expand (whatever that means), then you're headed for trouble.

As you do increasingly more back-of-the-head gazing, you hope that his fascination with the computer will wane like your childhood romance with yoyos. Reluctantly you will admit that your Home Computer User is *hooked;* any chance you might have had of turning him on to bowling is gone forever.

Re-decorating

As the HCU's hobby grows, so does the need to re-decorate your home. After he has conquered the mysteries of the basic computer set-up, his thirst for new "hardware" increases and living space will dwindle accordingly. Printers, terminals, disk drives and hexidecimal converters begin springing up around you, along with new "software": cassettes, disks, trade magazines, newsletters, brochures, bulletins and correspondence from computer club members. The daily delivery to your mailbox will soon prove too much for your postman. Our

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CIRCLE 121 ON READER SERVICE CARD

Computer, cont'd...

postman came after Barry with a machete soon after he got his first hernia.

All of this dictates a radical change in your living space. Of course, if you have a den or a rec room, there's probably no big adjustment; you can always set up the pool table in the kitchen. In our small apartment, Barry's side of the bedroom looks like a computer showroom. There is a console the size of a moose, a table for the word processor, a lamp, two stools for the disk drives, a chair, a bookcase for the cassette and magazine library, and myriad hanging cables which are hopelessly intertwined with the telephone wire.

Every time I pick up a home decorating magazine, I begin to weep quietly.

The Computer and Your Social Life

Dinners will grow cold to the chorus of, "Just a sec — I'm onto something!" When you entertain, guests will disappear with your HCU, eager to be introduced to the mysteries of zeroes and digits. Female guests will gasp appreciatively for about ten seconds and then retire tactfully to the powder room, relieved that "one of those things" isn't messing up *their* homes. Meanwhile, their husbands are willingly being sucked into the insidious world of computer ownership.

We once visited a couple who were planning to attend a fancy dinner party later that evening. As the husband demonstrated trick after trick on his new *color* computer, his wife would periodically send down a child to tell Daddy how many minutes he had to get ready for the party. By the time the husband was well into a computer program of the War of 1812, I nudged Barry who half-heartedly advised his pal to go upstairs and get dressed.

Barry promises to turn off the computer by midnight and I vow never to tapdance on the ceiling...

At last the oldest child came downstairs and in a perfect "wife-in-training" voice announced, "Mommy said to tell you to just forget the party." The import of these words were not wasted on any of us, including the kid. The husband sighed, turned off his computer and apologized to Barry, "It's that time of the month — ya know what I mean?" As we left some five minutes later, I wordlessly squeezed his wife's hand as she grimly nodded us out. I hope she crowned him.

Lest I paint too bleak a picture of the computer's effect on one's social life, let me add that this "hobby" will bring a lot of new people into your acquaintance. After Barry introduces me to his computer club buddies, they ask me if *I* am interested in computers, too. I usually reply by tearing Kleenex into little shreds, at which point they suggest that I meet their wives.

To sum up, you will have to forfeit your neat and attractive home. You will have to find a hobby of your own to compensate for your loss of male companionship. (Of course, you *could* always find a new male companion, but that's your business. I will stick to crossword puzzles.) You will have to accept the fact that you are now just the *second* most fascinating creature in the house.

However, it is also true that home computing is safer than race car driving, takes up less room than raising chinchillas, is less expensive than going through medical school and, best of all, it is a hobby that keeps the Home Computer User at home.

At least you always know where he is. □

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CIRCLE 148 ON READER SERVICE CARD

Do You Really Need REMark Statements?

G. R. Boynton

Perhaps not as many as you think

Readers of Creative Computing are regularly able to avail themselves of advice on good programming techniques. Much of this advice is helpful, but I would like to challenge one assumption shared by almost all of our advisers. There seems to be almost universal agreement that the beginning point of good documentation is the REMark statement. I have yet to see anyone challenge this mode of documentation except on the grounds of the cost in memory. But any documentation which is contained in the program itself will exact a cost in memory.

If I am going to challenge a view of good documentation as widely shared as the use of REMark statements I must first establish that there is a problem. The first step in establishing the problem is a brief program which has what might be called "normal form." It is the form of the program rather than its content that is important.

G. R. Boynton, Chairman, Dept. of Political Science, University of Iowa, Iowa City, IA 52242.

There are two points to be made about this program. First, it is modular. The modules are disjunctive; you can add or multiply. That is not necessary, but it is one way to be modular. Second, each of the routines is documented with a REMark statement. Reading through the program it is not difficult to tell what each set of lines is supposed to do.

Now for the problem. This program is extremely simple. It gives the user a choice between adding or multiplying two numbers, inputs the two numbers, adds or multiplies them, and then prints the results. Assume that the problem is more complicated. That would entail either more modules or more complicated modules or both. At least it would entail a substantially longer program, and that is where the rub comes in. Most of us "personal computers" are attached to CRT oriented machines. We can see, on the screen, sixteen to thirty lines at a time. If the program is 100 or more lines long we spend a lot of time searching back and forth trying to find the subroutine that inputs the data or adds the two numbers or whatever. REMark statements are not much help because they are embedded in the program along with the routine. If I cannot remember where the subroutine is located in the numbering system I also cannot remember where the REMark statement is that identifies it. I have to search, and the only way to do that is to push the whole program across the screen until I find what I am looking for, that is the problem. The REMark statement is no more locatable on my CRT than is any other statement.

The normal response to this quandary is to get a printer.Then the REMark statements show up very nicely as I am reading through the program. First, that is an expensive solution. The "cheap" printers sell for from $300 to $500, and most of them are only good for making listings of programs. The printers that will type text, like this manuscript, are much more expensive. Second, that is simply a futher illustration of the problem. The REMark statement is a holdover from before the days of the "tube." They work fine when the program is printed, and not too many years ago that was the only way you could look at a program. But today the situation is reversed. There are far more CRT's than there are printers. A CRT oriented alternative to the REMark statement is needed.

What if? You are writing a more complicated version of the above program. You try it out, and get some very funny numbers printed. So it is back to the calculating subroutine. But where is that routine. Now you type RUN 900, and the following appears on the screen:

```
10 REM PROGRAM TO ILLUSTRATE 'NORMAL' FORM
100 REM ROUTINE TO PRESENT OPTIONS TO USER
110 PRINT "WOULD YOU LIKE TO:"
120 PRINT TAB(5) "ADD"
130 PRINT TAB(5) "MULTIPLY"
140 PRINT "TWO NUMBERS"
150 INPUT A$
160 IF A$="ADD" THEN RO=1
170 IF A$="MULTIPLY" THEN RO=2
200 REM MAIN ROUTING ROUTINE
210 GOSUB 300
220 ON RO GOSUB 400,500
230 GOSUB 600
240 PRINT "WOULD YOU LIKE TO DO SOME MORE CALCULATIONS?"
250 INPUT A1$
260 IF A1$="YES" THEN 110
270 PRINT "SEE YA."
280 END
300 REM INPUT ROUTINE
310 INPUT A
320 INPUT B
330 RETURN
400 REM ROUTINE TO ADD
410 LET X=A+B
420 RETURN
500 REM ROUTINE TO MULTIPLY
510 LET X=A*B
520 RETURN
600 REM PRINT ROUTINE
610 IF RO=1 THEN PRINT A;"+";B;"=";X
620 IF RO=2 THEN PRINT A;"*";B;"=";X
630 RETURN
```

```
PROGRAM TO ILLUSTRATE 'NORMAL' FORM

ROUTINE TO PRESENT OPTIONS TO USER (110-170)
MAIN ROUTING ROUTINE (210-270)
INPUT ROUTINE (310-330)
ROUTINE TO ADD (410-420)
ROUTINE TO MULTIPLY (510-520)
ROUTINE TO PRINT (610-630)
```

REMark, cont'd...

You know right where to go. More to the point; you have executable documentation. One of the principal "virtues" of the REMark statement has been that it is not executable. It could be stuck anywhere in the program without interrupting the flow of the operation of the program. But if you are sitting in front of a tube, you need documentation that is more help than can be provided by a nonexecutable statement. I want executable documentation so I can get to it whenever I need it.

Before showing the modified program there are a couple of other points about executable documentation. First, it is not limited to listing subroutine location. Anything can be listed. If it is a long program which uses a large number of variables the variables and their use can be listed. If I really wanted to get fancy I could use the PET graphics to put in a flow diagram. Anything useful to the programmer, in keeping track of what is happening where, can be put into executable statements. Second, this is no more costly, in terms of memory, than are REMark statements. On my PET, PRINT statements require slightly less memory than do equivalent REM statements.

Now for the revised version of the 'normal' program.

It is essentially the same program. What were REMark statements are now print statements, and are collected at lines 900-920. I broke what appears to be one of the cardinal rules of "structured programming" by using an IF...THEN, GOTO combination, but I am not an ideologue. And I told myself where that GOTO statement was sending me. I used a REMark statement.

The executable documentation can be used in either of two ways. If I am not executing the program I can type RUN 900, and the documentation will appear on the screen. If I am executing the program I wait until I get to the options routine. Then I type "PROGRAM," and the documentation appears on the screen. After I press any key I return to the main progam. It is there whenever I want it.

I write fairly long, modular programs because I generally use the PET for information processing. This technique has been very helpful; I had to invent something or go crazy searching, and searching, and searching... As the apologists for structured programming note, any programming note, any program can be broken down into separate components. Since that is true, this technique of documentation should be useful in writing and updating any but the simplest of programs. It certainly makes it possible for me to write long programs without resorting to the printer all the time. □

```
110 PRINT "WOULD YOU LIKE TO:"
120 PRINT TAB(5) "ADD"
130 PRINT TAB(5) "MULTIPLY"
140 PRINT "TWO NUMBERS"
150 INPUT A$
160 IF A$="ADD" THEN RO=1
170 IF A$="MULTIPLY" THEN RO=2
180 IF A$="PROGRAM" THEN 900
210 GOSUB 310
220 ON RO GOSUB 410,510
230 GOSUB 610
240 PRINT "WOULD YOU LIKE TO DO SOME MORE CALCULATIONS?"
250 INPUT A1$
260 IF A1$="YES" THEN 110
270 PRINT "SEE YA."
280 END
310 INPUT A
320 INPUT B
330 RETURN
410 LET X=A+B
420 RETURN
510 LET X=A*B
520 RETURN
610 IF RO=1 THEN PRINT A;"+";B;"=";X
620 IF RO=2 THEN PRINT A;"*";B;"=";X
630 RETURN
900 PRINT "PROGRAM TO ILLUSTRATE 'NORMAL' FORM"
902 PRINT "ROUTINE TO PRESENT OPTIONS TO USER (110-170)"
904 PRINT "MAIN ROUTING ROUTINE (210-280)"
906 PRINT "INPUT ROUTINE (310-330)"
908 PRINT "ROUTINE TO ADD (410-420)"
910 PRINT "ROUTINE TO MULTIPLY (510-520)"
912 PRINT "ROUTINE TO PRINT (610-630)"
914 PRINT "PRESS ANY KEY TO CONTINUE"
916 GET G$:IF G$="" THEN 916
920 GOTO 110:REM RETURN TO OPTIONS ROUTINE
```


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CIRCLE 152 ON READER SERVICE CARD

A Program for Amateur Cryptologists

Stan and the Secret Language

N.B.Winkless, Jr.

We may be seeing encrypted messages used in electronic mail and in messages from one individual to another on community bulletin boards and other networks. And, perhaps Stan is leading the way.

Pop stepped quietly over a catcher's mask, a slalom ski, a crossbow and two rubber-tipped arrows, and a well-thumbed copy of **Advanced Basic,** and blind-sided young Stanislaus at the keyboard.

"Woops!" said Stan, as he realized he had company. He touched keys and the CRT went black. He grinned at his father. "No peeking!"

"Aw c'mon, kid," Pop said. "No secrets from your old man."

"Well, put it that way," Stan said, and touched keys again. "Just that I've been improving on my cipher stuff, and I wanted to surprise you."

"Look, I'm surprised you can do any programming at all, considering your genes. Whatcha got?"

"Remember I was working on ciphering with my tape Basic? Well, now with the disk, it's like water off a duck's beak."

"Back,"Pop said. "Show me."

The printer chattered, delivering this:

```
HSS NHBS PZ KPCPKLK PU AOYLL WHYAZ HUK P OHCL AHRL
U WHYA VUL   ZAHF ABULK  SVCL QBSPBZ
```

"Where was that?" Pop said.

"On the disk. Suppose the disk is sent by messenger, or through the mail. It can carry—what—three hundred thousand characters? A short book. All in cipher. So you could transmit sales reports you don't want your competitors to know...or a reporter's exclusive story...or diplomatic or military secrets..."

"Un hunh. If I come across any, I'll be able to protect 'em, right. Wonderful, Stan."

"So what does the message say?"

Pop studied it. "Well, no fair asking **me,** but they've got ways to crack these things. This is a substitution cipher, right? Frequency analysis, you know...they look for the letters most commonly used—e, t, a, o, i, n, s, h, r, d, l, u, like that..."

N. B. Winkless, Jr., 11745 Landale St., North Hollywood, CA 91607.

"Right." Stan nodded. "And that wouldn't be hard to do with this particular cipher because this is the old Caesar system—offset seven steps, in this case."

(The Caesar System—a seven-step offset:

```
The clear: a b c d e f g h i j k l m n o p q r s t u v w x y z
In cipher: h i j k l m n o p q r s t u v w x y z a b c d e f g
```

Just slip the alphabet a certain number of steps, and use the cipher equivalent in place of the clear character.)

"I've got a clue," Pop said. "This single letter is probably 'I' or 'a.' And the first word, three letters, the last two the same; must be a double—'dd,' or 'ee,' or 'gg' if it's 'egg,' or 'll,' or 'oo'..."

"Right. You could crack it yourself, Pop. Here's the message." He touched keys.

```
ALL GAUL IS DIVIDED IN THREE PARTS AND I HAVE TAKE
N PART ONE   STAY TUNED  LOVE JULIUS
```

"Yup!" said Pop. "Double 'l,' just as I said. And the single letter is 'I'..."

"Too easy. Good enough for Caesar, because his enemies probably weren't too sharp in Latin anyway, and a simple uniform offset would do. But suppose the offset isn't uniform? Suppose we let the computer generate a series of pseudo-random numbers and use them for the offset. See this."

```
JfW1WE c:WY4JT ZKHK&TW)eNZZJ:RNbbb1Kf]9O/cRb5PTkM5
YP!1FTZ+1VVY4YU]$-[N_GZ4ZV^2bXhUW8*KMXgOc
```

"Yipe!" said Pop. "You getting all this out of one program?"

"Not bad, eh Pop? Before I had the disk drive, I used to have to feed all that stuff by hand to get the translation. Now I just make it a file, and it's duck back."

"Soup," said Pop, studying the message. "I don't see any clue at all."

"Right. Here it is in English."

```
ALL GAUL IS DIVIDED IN THREE PARTS AND I MAY HAVE
TO TAKE THEM ALL  WATCH THE STORE  CAESAR
```

"Hmm," said Pop. "Are you going to show me the program?"

"One more version. In those two, we've put the ciphered message into characters. But suppose we just kept it in numbers—the ASCII values."

```
 79  108   76   95   83   73   42   96  109   46
 72   89   71   96   93   90   77   88   83   38
 84   87   41   87   71   84   97   51   58   88
 82   94   87   47  103   83   92   98   57   92
 88   89   90   55   53   82
```

Pop shook his head. "That's no fun."

"Worse than that. It's wasteful. I had to give every character five spaces, and I can get only 250 characters into one string. Here's that message."

```
FRANCE IS BEAUTIFUL IN FALL. VENI VIDI VICI. J
```

"Okay, Stan. How'd you do it?"

"This way. But notice: even if the enemy were to get hold of my program along with a copy of my ciphered message, there's NO WAY I can imagine for him to crack this system. The **code** is the seed that starts the series of 'random' values, and there's NO WAY to back into it. Is there?"

```
10 D$=CHAR$(27)+CHAR$(31)+CHAR$(10)
20 OPEN 0"*P":PUT 0 D$;: CLOSE 0
30 !The lines above set character spacing
40 DIM A$(250),B$(250),C$(250)
50 POKE(16R0512)=50
60 !Sets printer linewidth
70 PRINT "CIPHERING/DECIPHERING"
80 PRINT "BY STANISLAUS K. PURINTON"
90 PRINT "AUGUST 1979"
100 PRINT "WHICH WAY:"
110 INPUT "CAESAR(C)  STAN(S)  NUMBERS'N)";H$
120 IF H$="C" THEN R=1:!Flags to select route
130 IF H$="S" THEN S=1
140 IF H$="N" THEN N=1
150 INPUT "ENCIPH OR DECIPH (E/D)";W$
160 INPUT "CODE";C:R=RND(-C)
170 C=MOD(C,26)
180 ! Keeping Caesar within bounds
190 IF W$="D" THEN 1000
200 ! The decipher mode is below
210 PRINT "MESSAGE"
220 INPUT A$
230 ! Up to 250 characters at a time
240 L=LEN(A$):!How long is the message?
250 FOR X=1 TO L:! We'll go through it...
260 Y$=MID$(A$,X,1):! one character at a time
270 Z=ASC(Y$):! We identify the ASCII number...
280 IF N THEN K=Z+INT(26*RND(0)+1):Z$=FMT(K,"ZZZZZ
"):GOTO 340:!The numbers offsetter in one swell fo
op
290 IF S THEN 320
300 K=Z+C:!Caesar's offset
305 IF K>90 THEN K=K-26:! Staying in letters
306 IF Z=32 THEN K=32:!Keeping the spaces
310 GOTO 330:! Skip Stan's offsetter when Caesarin
g
320 K=Z+INT(26*RND(0)+1):!  Stan's offsetter
330 Z$=CHAR$(K)
340 C$=C$+Z$:! Put them together
350 PRINT Z$;:!We watch the characters added
360 NEXT X:! Go get the next character
370 PRINT:!To end the line.
```

Secret, cont'd...

```
380 PRINT CHAR$(15)
390 STOP
400 OPEN 1"GIBBERISH":PUT 1 RECORD 1 C$: CLOSE 1
410 STOP

1000  OPEN 1 "GIBBERISH":GET 1 RECORD 1  A$
1010  CLOSE 1
1020 PRINT A$
1030 PRINT CHAR$(15)
1040  L=LEN(A$)
1050 IF N THEN 1200
1060 FOR X=1 TO L
1070 Y$=MID$(A$,X,1)
1080 Z=ASC(Y$)
1090 IF S THEN 1120
1100 K=Z-C:!Caesar again
1105 IF K<65 THEN K=K+26:! The letters complement
1109 IF Z=32 THEN K=32:!Clinging to the spaces
1110 GOTO 1130
1120 K=Z-INT(26*RND(0)+1)
1130 Z$=CHAR$(K)
1140 C$=C$+Z$
1150 PRINT Z$;
1160 NEXT X
1170 PRINT
1180 PRINT CHAR$(15)
1190 END
1200 !
1210 FOR X=1 TO L STEP 5
1220 B$=MID$(A$,X,5)
1230 Z=VAL(B$)
1240 Q=INT(26*RND(0)+1)
1250 K=Z-Q
1260 Z$=CHAR$(K)
1270 C$=C$+Z$
1280 PRINT Z$;
1290 NEXT X
1300 GOTO 1170
```

Lines 10 to 90 set the printer format and identify the program; 100 to 150 set the flags for the route; 160 is what it says, locking in the seed; 170 uses the same seed for the Caesar offset, but limits it to a maximum of 26, not to outrun the alphabet; 190 sends the program to the decipher area if that's what's wanted; 220 is for the message in the clear, now known as A$. From 230 onward through 400 is a Duckwood sandwich ("Dagwood," said Pop) of the three enciphering methods: dissecting the message, finding the ASCII values of its characters, altering those values by plan, reassembling the result, putting the enciphered message into a Micropolis Basic file called "GIBBERISH," which must first be establishd as a new file before this program can run.

Lines 1000 to 1300 handle the deciphering just as you'd expect, subtracting the offsetting values that were added, and so restoring the original message. Stan found the third method, using numbers only, more trouble than he'd expected. Having created five-character blocks (back at line 280) to carry the two-digit numbers, he had to build a special dissection sequence — at 1200-1300—to cope with his creation. He's sure that there's a better way to work with numbers alone—something much more efficient, more compact, faster—and he's confident that the readers of **Creative Computing** will arise to tell him about it. □

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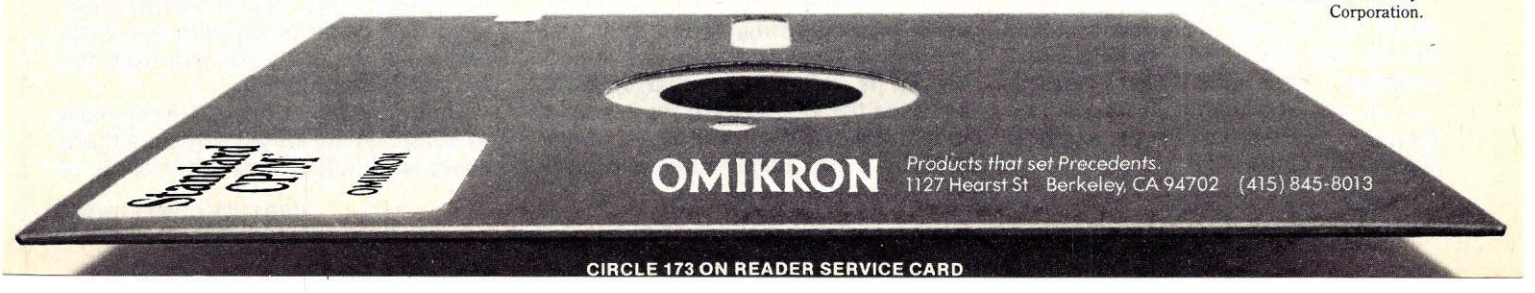
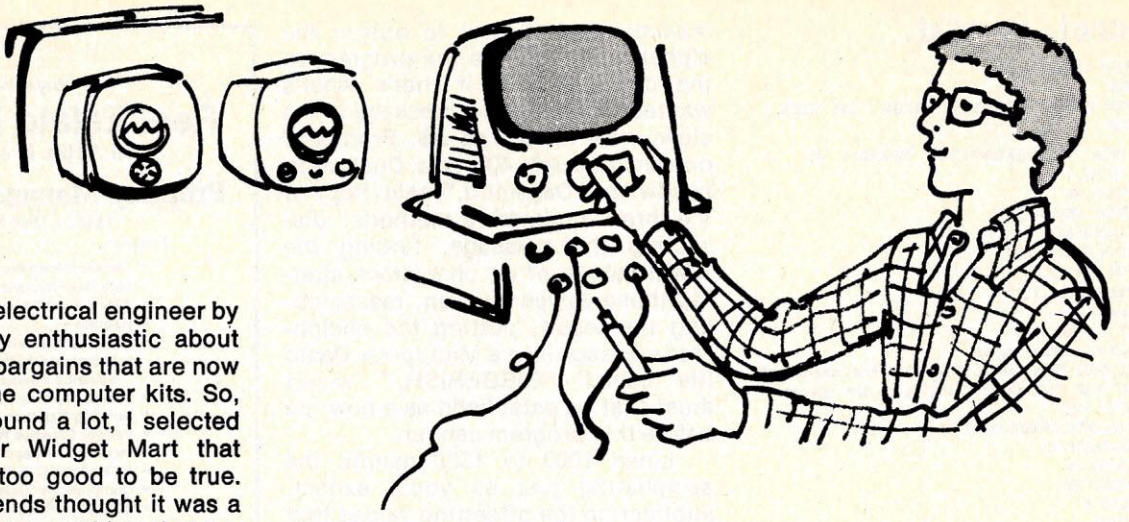
*CP/M is a TM of Digital Research. TRS-80 is a TM of Tandy Corporation.



CIRCLE 173 ON READER SERVICE CARD



The Kit That I Bought

Ronald Pearson

Since I am an electrical engineer by trade, I was very enthusiastic about the tremendous bargains that are now available in home computer kits. So, after looking around a lot, I selected one from Super Widget Mart that seemed almost too good to be true. Not all of my friends thought it was a good idea to buy something that expensive from a company that also repaired lawn mowers and diesel tractors, but my keen financial sense told me there was an undiscovered gold mine here, and besides, I was intrigued by their ¼ horsepower Briggs and Stratton interface card, so I sent away for it. Since many others are probably now facing similar decisions, I felt it my duty to help by providing an unbiased description of my experiences. (So here is the story of the kit that I bought.)

Well, before **too** long I had the actual kit in hand, and, except for a few items, it seemed to be in good condition. I started learning new things right away, too — like the term "baudot keyboard" and the fact that it was somehow incompatible with the term "ascii tv typewriter and software." But they had been nice enough at the factory to include a note telling me about their new baudot to ascii converter board that would solve all of these problems for only $49.95. Since I had spent about fourteen times that much on the kit, it seemed a small price to pay. I didn't really mind the delay either, because all of the software had been temporarily out of stock so it would be a while yet before I could use it. (Minor inconveniences, really — just a few parts missing from the kit that I bought.)

A few minor problems have come up. Nothing really, just little things . . .

After a while, when most of these parts had arrived, I started building the kit and have been making good progress over the past several months, although a few minor problems have come up. Nothing really, just little things . . .

. . . like the "pre-formed" capacitors that didn't quite fit the holes in the PC boards and had to be "post-formed" a little to make them go in . . .

. . . the disparity between part numbers on the schematics and those on the parts was a little disturbing at first, but most of them turned out to be equivalent . . .

. . . the "attach pushbutton debounce circuit" wasn't, but they're not too hard to design . . .

. . . the power supply and ground were shorted on the preassembled keyboard and, even though all of the IC's are soldered in, there aren't too many of them, so with a couple of week's work I should be able to tell whether it's one of them or an etch short on the board itself . . .

. . . but you have to expect a few things like this. (After all, they're just the minor problems that came along with the parts that were originally missing from the kit that I bought.)

After overcoming some of these minor obstacles, I began to feel a close alliance with the engineers who designed my kit, mostly because of the way they included me in the design process. For example, all designs involve repeated revisions, usually denoted by letter, but normally only the last one gets shipped. My kit is different in that respect, because the CPU board, for example, is marked "REV A" and is accompanied by a two page schematic composed of one "REV A" sheet and one "REV B" sheet and, for simplicity, an overall schematic reduced to one page that's marked "REV C." There's also an assembly drawing showing where all of the parts go that's marked "REV 0," but I think that's a mistake. But the designers tied it all together for me by sending a sheet that explained exactly which strips of etch to cut and what new wires to attach to the "REV A" PC board to make it match the "REV C" schematic. This was a lot of work, but I had a friend help me with it who was good at the very tricky soldering and etch cutting required, so it only took one evening to get the modifications made. When I began actually building the board the next day, I felt good that I had save the company a painful ECO.* (Besides, these were the changes that corrected some of the minor problems that came along with the parts that were originally missing from the kit that I bought.)

Not all of my friends thought it was a good idea to buy something that expensive from a company that also repaired lawn mowers and diesel tractors.

Unfortunately, I haven't been able to complete my kit yet, because there seem to be a few bugs left in some of

Ronald K. Pearson, 123 Elm St., Apt. B11, Quincy, MA 02169.

the boards that I haven't been able to track down. I have done pretty well so far, though, and have acquired a lot of spare components, test leads, IC clips, homemade signal generators, and semiconductor manuals in the process, but I do need a better scope to replace the $85 Heathkit I got when I was fourteen. (I know just the one I need, too — multiple trace, 50MHz bandwidth, delayed sweep, built-in logic analyzer — and it doesn't cost that much more than a small car).

Overall, though I am pretty happy with my kit . . .

. . . the clocks on the baudot to ascii converter board seem to work ok, except for the one output from one of them that hangs around 2.5 volts all the time . . .

. . . and the power supply is really nice, delivering lots of amps at several unusual voltages (and it doesn't look nearly as bad as people say with the extra PC board mounted on the case and the extra wires strapped to it with yellow electrical tape) . . .

. . . they expect to get the bugs out of the rest of the software before too long, so I should have my 5K Basic any time now . . .

. . . besides, I think I can modify the memory board I got with it to make it compatible with the pre-assembled and tested KIM-1 I just bought. (After all, I want **something** to program while I'm saving my money to buy the stuff I need to debug the changes that corrected some of the minor problems that came with the parts that were originally missing from the kit that I bought.) □

*"ECO" is an acronym for "engineering change order" and works something like this — suppose you are a production manager for the Gargantuan Gismoe Corporation and are sleeping peacefully after seventy-two continuous hours of pushing your assembly line to prepare a rush order of sixty thousand obscure gadgets for immediate shipment. Then, at four a.m., just hours after the last one has been loaded on a special cargo plane for Jakarta, Indonesia, your phone rings and and it's somebody from engineering.

"Say, Fred, about that order you just shipped, it seems that Dick, here, just discovered that if you start the system in test mode and then toggle the master-slave interface switch, it overloads the front end and blows all of the analog stuff — fries it to a crisp."

"What?" you ask dumbly.

"Sorry, Fred, but it looks like we'll have to call everything back so we can redesign the . . ."

. . . well, you get the idea. It's this sort of thing that gives engineering a bad name and makes one cringe at the sound of the initials ECO.

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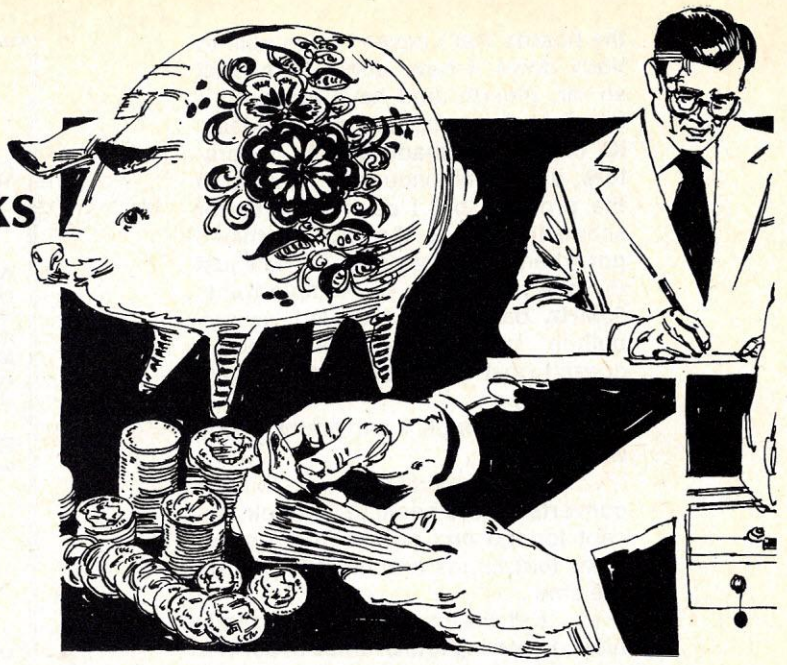
CIRCLE 141 ON READER SERVICE CARD

Introduction To Stocks and Listed Options



Alfred Adler, Ph.D.

Several years ago the author asked himself the following question: How can money be used to make more money, without becoming involved in a product or a service? By this is meant consistent, long term income, not sporatic profits interspersed with long periods of loss. One immediately thinks of the gaming tables at Las Vegas, but as everyone knows, or should know, the game is stacked against the player, so that the longer he plays the more closely he approaches the certainty that he will lose. Even those few, and there are some, who have devoted the time and effort to acquiring the skills required to win, find that they quickly become known with major adverse consequences.

Some people try the commodity futures market. They might be better off in Las Vegas. One of the largest brokerage houses in the country states publicly that more than 95% of their commodities clients lose their shirts within the first year. A relatively small number of people seem to be able to consistently and successfully invest in real estate. This is a highly specialized endeavor, requiring either certain unusual talents or the good fortune to be in the right place at the right time and above all the ability to recognize the fact. Last but not least, there are the various security markets which, of course, will be our main focus of interest.

During the past several years considerable effort has gone into researching methods of tilting the odds in the investment game. Out of this has come the discovery that not only can the odds be tilted but that they can be tilted drastically, and in either direction. In particular, the strategy of hedging listed options against common stocks, when properly applied, can be proven to be more conservative and more consistently profitable than the simple buying and selling of stocks; so much so, in fact, that very conservative financial institutions such as bank trust departments, insurance companies, public pension funds, mutual funds, endowments and charitable foundations have begun trading options. The idea of an investment being more conservative and at the same time more profitable of course violates one of the widely 'known' tenets of Wall St. However, in recent times much that was widely 'known' has been found to be wrong.

Very often an established company needs additional funds and chooses to obtain it by issuing additional stock.

This recent trend was discussed in a front page article in the December 1, 1976 issue of the Wall Street Journal.

Theory indicates that a consistent average return of 20% per year should be readily obtainable, and experience to date seems to bear this out. A confirming viewpoint is given in an article on page 28 (Your Money Matters) of the Wall Street Journal for July 17, 1978.

The only disadvantage of this strategy is its complexity. Certain tactics, by their very nature, tend to shift the odds in your favor, while certain other tactics, by their nature, make it almost impossible not to lose. The only viable alternative to employing the dubious talents of a professional is a large initial investment in self-education plus a continuing expenditure of much time and effort.

The author's interest in stock market operations is primarily from the point of view of a mathematician. He firmly believes that the market is inherently unpredictable and that strategies based on hedging and the mathematics of probability are far more likely to be successful than those based on 'fundamentals,' 'technical factors,' or the reading of tea leaves. An ongoing study of investment strategies has included a series of computer programs which were written primarily for study purposes. The more useful of those have evolved into production programs which are used in the everyday management of investments.

A series of articles is being presented dealing with these programs. Part 1, which follows, provides an introduction to investment in stocks and listed options with particular emphasis on the latter. Parts 2 through 5 will each deal with a particular program. The programs were originally developed in PolyMorphic Basic, and have recently been revised and converted to North Star Basic. They are currently available in TRS-80 16K Level II from Creative Computing Software.

The four programs to be presented are designed to be used in the real world, and include the effects of commissions, margin interest, and dividends, where applicable. The first presents the important indices for both opening and closing call option transactions. Another presents a graph or a table, as the user chooses, of profit from any combination of six basic positions: long or short a stock, long or short a call, and long or short a put. The third program enables the user to predict the future price of an option at user chosen future times based on user chosen future stock prices. Finally, the fourth program enables the user to

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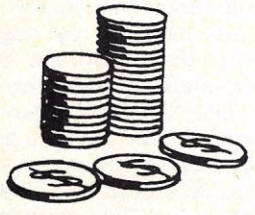
Advanced Statistics, CS-3303 (16K)

Text and graphics are skillfully combined to plot a variety of graphics functions. Display your data in sleek easy-to-read bar, line, or cartesian coordinate X,Y graphs. A polar coordinate graphing program automatically scales and labels polar functions. The parametric graphing routine graphs X vs Y in terms of an independent variable. Two regression routines analyse data to see how well a series of points fit on a linear or quadratic function so the information can be effectively entered into the graphing routines (for Level II) $7.95.
A Tape Manager/Graphics/Statistics package is also available for Level I, CS-2301 (4K) $7.95.



Investment Analysis, CS-3305 (4K)

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Text Processing, CS-3302 (16K)

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Stocks, cont'd...

determine, on an item by item basis, the cost, current value per share, total current value and capital gain of a portfolio consisting of long and short stock, and long and short option positions.

Introduction To Stocks and Listed Options

For most people, buying and selling common stocks in the hope of realizing capital gains is the strategy of choice. During the seventies, however, this strategy has been anything but consistently successful. Many people buy 'services' in an effort to enhance their performance. Such services may range from a page or two of weekly advice to the complete management of a portfolio. In any case, it is obvious that an individual or group of individuals, educated in finance, with many years of experience, devoting their working hours exclusively to the management of investments can obtain performance beyond the reach of the average small investor. It is obvious, but like so many other things that are obvious, it just doesn't happen to be true. Many books on investing will flatly state that the average investor, in the long run, does at least as well, and usually better, than fund managers, advisory services, and other presumably knowledgeable people. An article by Martin E. Zweig entitled 'Darts, Anyone?' which appeared in the February 19, 1973 issue of Barron's dealt with this subject in some detail. This article lambasts everyone and provides a considerable bibliography of articles which do the same. The author has never seen a statement in print (except for advertisements) which says anything to the contrary. The author's personal experience includes dealings with several of the world's largest brokerage houses. They each employ a large number of people with many years of education and experience in market operations. On a long term basis, not one of these highly paid and even more highly touted research departments has been right anything like 50% of the time. Anyone who regularly acts on such advice would be as well off throwing darts at the stock market page of the daily newspaper. As a matter of fact, a study conducted more than ten years ago at one of our major universities came to just that conclusion. A computer simulation of just such dart throwing showed a profit of a fraction under 10% during a period when most fund managers were not doing nearly as well.

Having thus roundly undercut everything and everybody who might lend assistance to the small investor, and left him friendless and alone, what can the author offer in return? First of all, the certain knowledge that he/she is not nearly as defenseless as the experts would have him/her believe; second, a few ideas to chew on; and finally confidence in the fact that his/her good judgement and common sense (which seem to be in pitifully short supply these days), aided by a continuing effort at self education, will in the long run result in a very creditable performance.

Stocks

As opposed to a bond, which is an indebtedness on the part of the issuer, a share of common stock represents ownership of part of the business. The owners of common stock in a company own the company in common. Common stock is originated (issued) by the company when it needs to raise capital. Typically this occurs at the time the company starts into business, but very often an established company needs additional funds and chooses to obtain it by issuing additional stock. In either case, the stock is sold to whoever is willing to make an investment in the company. It may or may not be sold through a broker. In the case of an additional offering it may or may not be offered preferentially to the existing stockholders. It will in general be bought by individuals, other companies, institutional investors, etc. Once these entities have acquired the stock, they each own some part of the company. They are in general entitled to elect directors, receive a share of the profits of the company and so forth. Receipt of a share in the profits is usually in the form of dividends voted on a regular basis by the board of directors. Of course there is another interesting way to share in the profits of your company and that is by watching the value of the stock rise. Since supply and demand govern the price of a share of stock to a greater extent than they do for probably any other commodity, price is the best measure of value that is available. It is likely that more people buy stock in the hope of a price rise than buy it to participate in the dividends.

The idea of an investment being more conservative and at the same time more profitable violates one of the widely 'known' tenets of Wall Street.

In any event, before stock in any venture can be offered to the public it must comply with various federal and state regulations. The Securities and Exchange Commission, set up by Congress in the 1930's to protect the small investor, requires the filing of a lengthy registration form intended to provide the public with full information on the issue. In addition, the various states each have their own set of regulations, all different, of course. Every aspect of the securities industry is closely regulated, making it by far the most highly regulated industry in the United States.

Once the stock is in the hands of the original buyer, it can be bought and sold just like any other personal property. It is not necessary to use the services of a stockbroker, nor a stock exchange. These entities are available for the same reason that realtors and employment agencies exist, namely, to provide a meeting place for buyer and seller. It is a fact, however, that the vast majority of trading is done through brokers and stock exchanges. We will therefore consider certain details of such operations.

The Stock Market

First of all, let us realize that the stock exchanges don't buy stock, they don't sell stock, they don't even own stock. Further, the stock exchanges have nothing to do with setting prices of stocks. The public does that. The price of a stock is determined by a two-way auction. Buyers compete with buyers and sellers compete with sellers. A transaction is concluded when the buyer willing to pay the highest price and the seller willing to sell at the lowest price come to agreement. This is probably the closest the real world ever gets to the classical definition of a 'free, open, and competitive market.'

Anyone who wants to buy or sell stocks should have an account with a broker. This can be opened much as one opens a bank account. As with a bank, there are many types of accounts, the most popular of which is the cash account. This means that purchases are paid for by cash or check within five business days. Similarly, proceeds of sales are delivered by check, also within five business days. If your credit is established and you can meet certain other financial requirements, a margin account is available. This permits you to make purchases on credit much as one buys a car on time, except that only the interest must be paid. Principal payments may be deferred until the stock is sold, at which time either the principal is paid off or another purchase is made. The amount of the down payment or 'margin requirement' is fixed by the Federal Reserve Board and adjusted from time to time, much as they adjust interest rates and for related reasons. The margin requirement is currently, and has been for a

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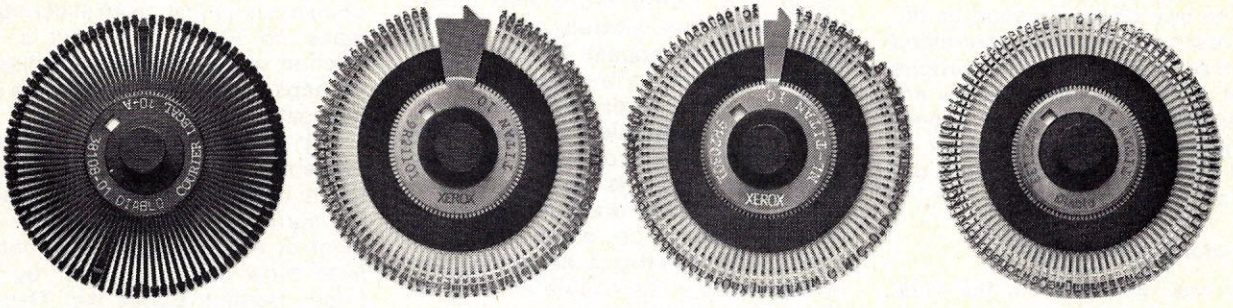

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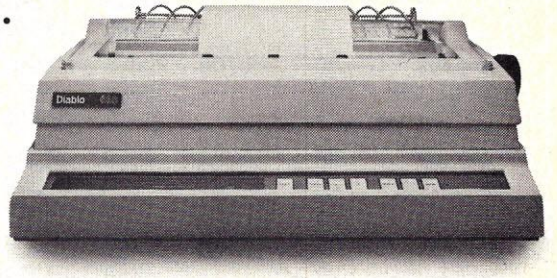

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CIRCLE 134 ON READER SERVICE CARD

Stocks, cont'd...

number of years, 50% of the full purchase price.

Having a brokerage account, one can buy or sell shares of stock by simply telephoning the broker and giving instructions. These orders are telephoned to the floor of the exchange where there are numerous 'trading posts.' Each of these is a horseshoe shaped counter around which the floor brokers take part in the auction. Each trading post handles approximately 75 different stocks. When your order reaches the floor, the telephone clerk writes it down and hands it to the floor broker, who goes to the appropriate trading post and attempts to execute the order.

A number of different types of orders are available. The most direct is the so called 'market order.' This is an order to buy or sell as soon as possible at the current market price. For those wishing to buy or sell as soon as the market reaches some predetermined level, either higher or lower, various types of 'stop' or 'limit' orders are available. Theoretically, these appear to offer many advantages, however, in practice they do not always work out well for a number of reasons.

Brokers and Commissions

And now we come to the least appealing part of investment transactions, the cost. Benjamin Franklin is reported to have said, '. . . in this world, nothing is certain but death and taxes.' If Ben had dabbled in the market he might have added 'commissions.' And make no mistake about it, it costs money to buy and it costs money to sell. If your stock goes up enough you will make money, if it goes down you will certainly lose money. If it remains the same or even goes up fractionally, you will lose. Your broker, however, always makes money. The amount of the commission depends on the number of shares and the total cost. Typical commissions at a full service brokerage house are as follows: For 100 shares of a $10 per share stock you will pay about $40, or 4%. For 2000 shares of the same stock you will pay $380, or about 1.9%. However, for 400 shares of a $50 stock, costing the same $20,000, you will pay only $285, or about 1.4%. As the amount spent drops below about $10,000, the cost rises above 2%, rising more and more steeply as the amount of money becomes quite modest. This makes it very expensive, and less and less profitable, for the very small investor. Since the commission is paid each way, that is, when you buy and again when you sell, it is obvious that a limited amount of money should not be spread among too many different issues. Added to this is the fact that an investor with a reasonable amount of money can usually pressure his broker into a discount, and the more reasonable his funds, the larger discount he can usually obtain. For those who are willing to accept bare bones service, generally limited to executions only, there are the discount brokers. These are advertised in the larger newspapers, and may offer discounts of 50% or more from the full service houses. One should consider the following before leaping, however. A full service broker may, repeat may, be willing to give the extra attention required to obtain a slightly better execution. After all, he puts about one-third of the commission into his own pocket; he should be willing to make an effort to keep the account. A small fraction of a point made or lost on an execution can make up for or wipe out a major fraction of any commission discount. Perhaps a full service broker is worth his cost?

One would be as well off throwing darts at the stock market page of the daily newspaper.

It is not possible in the space available to treat the subject in sufficient detail to even say we scratched the surface. A rather complete treatment of the subject can be obtained from 'How to Buy Stocks,' by Louis Engel, Bantam Books Inc. This book stands out as a beacon in a sea of verbiage and is truly worthwhile reading. Most brokerage houses have been giving them out to clients for the past two decades or more.

Investment Strategies

Those who venture into the security markets can be divided into investors, speculators, traders, etc. These terms mean different things to different people, and can become emotionally charged. In certain circles 'investor' has considerable snob appeal, while 'speculator' is not exactly complimentary. Be that as it may, these terms generally connote the time scale over which one tends to alter his position and the degree of risk one is willing to take. Generally speaking, positions should be altered when they are no longer suitable, without regard to the time since the last alteration. And the degree of risk must be measured against the likely reward, the financial ability of the individual to tolerate the loss, and the psychological ability of the individual to live with the risk. J. P. Morgan was reported to have advised, 'If your investments keep you awake at night, sell down to the sleeping point.' We will adopt the term investor to cover all time scales and all degrees of risk.

Investors may also be divided into

TABLE I

Results of Five Different Strategies
for Three Final Stock Prices

Assumptions:
Initial stock price = $22
Premium = $3.50 for exercise price of $20
Premium = $1.25 for exercise price of $25

Security Bought	Final Stock Price	Total Cost	Net Sale	Profit	% Profit
500 shs.	30	11131	14843	3712	33
	22		10869	-262	-2
	14		6899	-4243	-38
30 calls	30	10700	29693	18993	178
ex. pr. 20	22		5829	-4871	-46
	14		0	-10700	-100
88 calls	30	11392	43400	32048	281
ex. pr. 25	22		0	-11392	-100
	14		0	-11392	-100
5 calls	30	1798	4929	3131	174
ex. pr. 20	22		959	-839	-47
	14		0	-1798	-100
5 calls	30	663	2445	1765	260
ex. pr. 25	22		0	-663	-100
	14		0	-663	-100

READY
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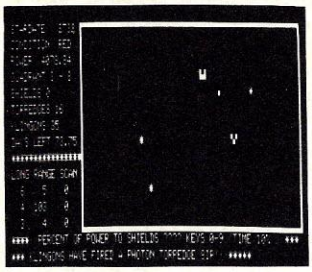

PACKAGE ONE INCLUDES: GRAPHIC-TREK "2000" — This full graphics, real time game is full of fast, exciting action! Exploding photon torpedoes and phasers fill the screen! You must actually navigate the enterprise to dock with the giant space stations as well as to avoid klingon torpedoes! Has shields, galactic memory readout, damage reports, long range sensors, etc! Has 3 levels for beginning, average, or expert players! ★ **INVASION WORG** — Time: 3099, Place: Earth's Solar System Mission: As general of Earth's forces, your job is to stop the Worg invasion and destroy their outposts on Mars, Venus, Saturn, Neptune, etc! Earth's Forces: Androids — Space Fighters — Lazer Cannon — Neutrino Blasters! Worg Forces: Robots — Saucers — Disintegrators — Proton Destroyers! Multi level game lets you advance to a more complicated game as you get better! ★ **STAR WARS** — Manuever your space fighter deep into the nucleus of the Death Star! Drop your bomb, then escape via the only exit. This graphics game is really fun! May the Force be with you! ★ **SPACE TARGET** — Shoot at enemy Ships with your missiles. If they eject in a parachute, capture them — or if you're cruel, destroy them! Full graphics, real time game! ★ **SAUCERS** — This fast action graphics game has a time limit! Can you be the commander to win the distinguished cross! Requires split second timing to win! Watch out!

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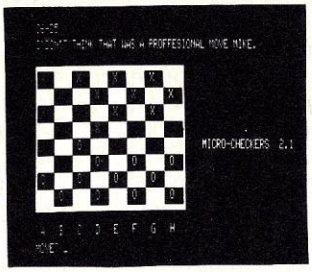

PACKAGE TWO INCLUDES: CHECKERS 2.1 — Finally! A checkers program that will challenge everyone! Expert as well as amateur! Uses 3-ply tree search to find best possible move. Picks randomly between equal moves to assure you of never having identical games. ★ **POKER FACE** — The computer uses psychology as well as logic to try and beat you at poker. Cards are displayed using TRS-80's full graphics. Computer raises, calls, and sometimes even folds! Great practice for your Saturday night poker match! (Plays 5 card draw). ★ **PSYCHIC** — Tell the computer a little about yourself and he'll predict things about you, you won't believe! A real mind bender! Great amusement for parties. ★ **TANGLE MANIA** — Try and force your opponent into an immobile position. But watch out, they're doing the same to you! This graphics game is for 2 people and has been used to end stupid arguments. (And occasionally starts them!) ★ **WORD SCRAMBLE** — This game is for two or more people. One person inputs a word to the computer while the others look away. The computer scrambles the word, then keeps track of wrong guesses.

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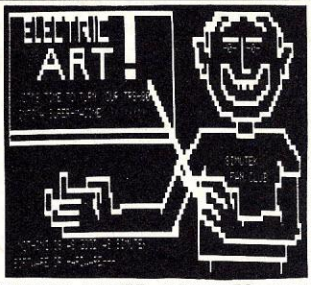

PACKAGE THREE INCLUDES: POETRY — This program lets you choose the subject as well as the mood of the poem you want. You give TRS-80 certain nouns or names, then the mood, and it does the rest! It has a 1000-word + vocabulary of nouns, verbs, adjectives and adverbs! ★ **ELECTRIC ARTIST** — Manual: draw, erase, move as well as, Auto: draw, erase and move. Uses graphics bits not bytes. Saves drawing on tape or disk! ★ **GALACTIC BATTLE** — The Swineus enemy have long range phasers but cannot travel at warp speed! You can, but only have short range phasers! Can you blitzkrieg the enemy without getting destroyed! Full graphics — real time! ★ **WORD MANIA** — Can you guess the computer's words using your human intuitive and logical abilities? You'll need to, to beat the computer! ★ **AIR COMMAND** — Battle the Kamikaze pilots. Requires split second timing. This is a FAST action arcade game.

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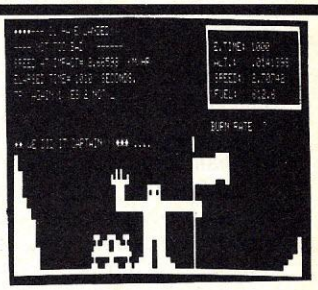

PACKAGE FOUR INCLUDES: LIFE — This Z-80 machine language program uses full graphics! Over 100 generations per minute make it truly animated! You make your starting pattern, the computer does the rest! Program can be stopped and changes made! Watch it grow! ★ **SPACE LANDER** — This full graphics simulator lets you pick what planet, asteroid or moon you wish to land on! Has 3 skill levels that make it fun for everyone. ★ **GREED II** — Multi-level game is fun and challenging! Beat the computer at this dice game using your knowledge of odds and luck! Computer keeps track of his winnings and yours. Quick fast action. This game is not easy! ★ **THE PHARAOH** — Rule the ancient city of Alexandria! Buy or sell land. Keep your people from revolting! Stop the rampaging rats. Requires a true political personality to become good! ★ **ROBOT HUNTER** — A group of renegade robots have escaped and are spotted in an old ghost town on Mars! Your job as "Robot Hunter" is to destroy the pirate machines before they kill any more settlers! Exciting! Challenging! Full graphics!

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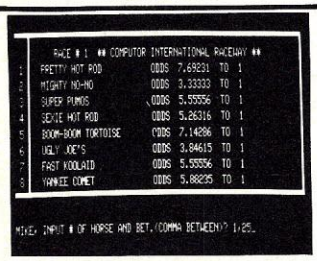
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SEXIE HOT ROD ODDS 5.26316 TO 1
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PACKAGE FIVE INCLUDES: SUPER HORSERACE — Make your bets just like at the real racetrack! 8 horses race in this spectacular graphic display! Up to 9 people can play! Uses real odds but has that element of chance you see in real life! Keeps track of everyone's winnings and losses. This is one of the few computer simulations that can actually get a room of people cheering! ★ **MAZE MOUSE** — The mouse with a mind! The computer generates random mazes of whatever size you specify, then searches for a way out! The second time, he'll always go fastest route! A true display of artificial intelligence! Full graphics, mazes & mouses! ★ **AMOEBA KILLER** — You command a one man submarine that has been shrunken to the size of bacteria in this exciting graphic adventure! Injected into the president's bloodstream, your mission is to destroy the deadly amoeba infection ravaging his body! ★ **LOGIC** — This popular game is based on Mastermind but utilizes tactics that make it more exciting and challenging — has 2 levels of play to make it fun for everyone. ★ **SUBMARINER** — Shoot torpedoes at the enemy ships to get points. Fast action graphics, arcade type game is exciting and fun for everybody!

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Simple hook up: Just plug cassette remote jack into unit.

EASILY CONTROLLED FROM BASIC:

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OUT 255,0 = off

MICRO-BEEP make games more fun as well as provide useful sound output for professional applications!

Works with Any Model I TRS-80

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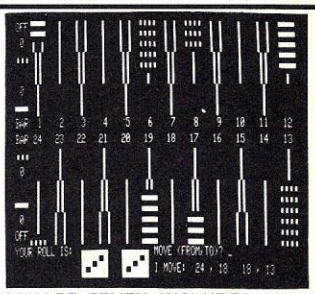

PACKAGE SEVEN INCLUDES: BACKGAMMON 5.0 — 2 different skill levels make this game a challenge to average or advanced players FAST (15 second avg) Looks for best possible move to beat you! FANTASTIC GRAPHICS. Plays doubles and uses international rules ★ **SPEED READING** — Increases your reading speed. Also checks for comprehension of material. Great for teenagers and adults to improve reading skills ★ **PT 109** — Drop depth charges on moving subs. Lower depths get higher points in this fast action graphics game. ★ **YAHTZEE** — Play Yahtzee with the computer. This popular game is even more fun and challenging against a TRS-80! ★ **WALL STREET** — Can you turn your $50,000 into a million dollars? That's the object of this great game Simulates an actual stock market!

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CIRCLE 193 ON READER SERVICE CARD

Stocks, cont'd...

fundamentalists and technicians, or chartists. Fundamentalists believe that if the company makes a product which will remain in demand, if their sales increase year after year, their earnings increase year after year, their dividend keeps rising, their outstanding debt remains low, etc., etc., the stock MUST rise. It sounds good, it just doesn't happen to be so. There are many examples of stocks in leading companies with excellent fundamentals, AT&T, GM, DuPont, to name a few, which went absolutely nowhere for many years. Technicians or chartists on the other hand are not interested in fundamentals but believe that by studying the past price history of a stock, its future price history can be predicted. This is not completely without foundation, over a very short period of time, sometimes, maybe, unless.

A time honored, conservative, investment strategy is to pick a 'good' stock, buy it when it is 'low,' and then 'just sit back and be patient.' What do we mean when we say a stock is 'low'? Do we measure 'low' in terms of price, price to earnings ratio, history, relation to others in its group? How? If a company has had stable earnings and its stock has sold within 10% of $50 for several years, and then within a short time drops to $30, while the company's earnings drop to half, is the stock now 'low'? Suppose you come upon a set of circumstances where you feel that by any set of standards the stock is indeed 'low.' Since this price represents a consensus of the investing public, you are now forced to ask, 'Do 'they' know something that I don't know, or are 'they' all wrong?' It takes sheer guts to fly in the face of popular opinion and yet, more often than not, it is winning play.

Anyone using the above strategy presumably is convinced that his stock will rise in price. That being the case, he could make a much higher return on his investment, or greatly limit his possible losses, or both, by trading in listed call options either instead of, or in conjunction with, the stock. This will be discussed in some detail a little later.

An option is the right, acquired for a consideration, to buy or sell something at a fixed price, within a specified time. When applied to the purchase or sale of common stocks, an option to buy the stock is referred to as a 'call,' and an option to sell the stock is referred to as a 'put.' Before the advent of the Chicago Board of Options Exchange (CBOE), and 'listed options,' puts and calls were sold by put-and-call dealers. Prices and terms varied little from dealer to dealer. Expiration times were 30, 60, or 90 days, or 6 months, from the day the option was acquired. The exercise, or striking prices (the prices at which the options were exercisable) were set relative to the current market price. Thus an option bought today locked the buyer and seller together for the life of the option. It could not be sold tomorrow since tomorrow's option had a different expiration day, and very likely a different exercise price. In other words, once you bought an option you were pretty much stuck with it. There was no secondary market. All of this made trading in options a very highly specialized, difficult, and risky operation.

Every aspect of the securities industry is closely regulated, making it by far the most highly regulated industry in the United States.

CBOE — Listed Options

In April of 1973, the CBOE was born and with it came a revolution in option trading. Expiration dates and exercise prices are now standardized and options are traded on an exchange by an auction system much like stocks are. All options run for 9 months from introduction to expiration. All options expire on the third Friday of their month, and within a few days a new option is introduced which will expire 9 months hence. For any given stock an expiration occurs every 3 months. The particular set of months is referred to as the 'series.' Thus, for each stock on which options are offered, there are 3 options available at any one time. For example, on January 1, 1980, IBM options were available which expire on January 18, 1980, April 18, 1980, and July 18, 1980. After January 18, a new option expiring on October 17, 1980 will be introduced. Following April 18, an option expiring on January 16, 1981. Thus, IBM options could be said to follow the January series. National Semiconductor options, on the other hand, follow the February series, which means that expiration occurs on the third Friday of February, May, August and November. The exercise prices are similarly standardized. Exercise prices occur every $5 between $5 and $50, every $10 between $50 and $200, and every $20 above $200. As the price of a stock moves up or down, additional options are introduced according to a prescribed set of rules. Thus, options traded at different times are interchangeable, the tie between the buyer and the seller does not exist, and a large secondary market in options exists.

In January of 1975, the American Stock Exchange started trading options, and in June of that year a third options exchange opened. By the end of 1975, the pace of options trading had risen to the point where the share volume of the CBOE alone was second only to that of the NYSE.

In order to be listed for options trading, a stock has to meet more stringent requirements than for trading on the Big Board. By the beginning of 1976, listed options were being traded on the stocks of 150 of the most popular blue chip and glamour stocks on Wall Street. Today that list has grown to about 200, and some of the most popular options are traded on more than one exchange, and in more than one monthly series.

Option Strategies

Investors trade in options for many reasons and in many ways, from the most conservative to the most dangerous. Buying options rather than stocks increases the investors leverage tremendously. It is easily possible to double your investment in a few days; it is just as easy to halve it as quickly. At the other end of the scale, call options may be sold against existing long stock positions, thereby increasing net income, providing a bit of downside protection, and decreasing the risk over that of stock ownership alone. Options may be bought to fix a stock price for future investment, protect a short sale, put a limit on risk, maintain a position through a slump, or accomplish any of several other objectives. Finally, a significant number of tax saving or deferment maneuvers can be performed with options.

Option trading strategies are most easily discussed if they are first divided into buying and selling, then into puts and calls, and finally combinations thereof. Several overall basic truths can be asserted. First of all, an option is a wasting asset. Time is on the side of the seller. For that reason alone the odds are against the option buyer and in the long run he will lose. On this all the books agree. There is an additional subtlety, however, as follows. Before the purchase of an option can be profitable the option premium (its cost) must rise not only by the amount which the passage of time has eroded, but additionally by the round trip commissions. In other words, for an option buyer to stay even, the option premium must take an immediate jump and then rise continuously. This, of course, requires that the stock take a little jump and then rise continuously. Since stock price is just as likely to fall as to rise, and very likely to not do much of either, the option buyer certainly has an uphill battle.

Stocks, cont'd...

In the remaining articles, strategies involving the buying and selling of puts and calls will be discussed in considerable detail. For the present we will simply examine the purchase of calls versus the purchase of the underlying stock.

Let us return to the 'time honored, conservative' strategy mentioned previously and see if it can be improved upon. If the investor is truly confident that his stock will rise, he might consider buying calls instead. For example, suppose Control Data (NYSE symbol CDA) is selling at $22 and our friend decides that it is likely to move to at least $30 within 3 months. If he buys 500 shares his total cost is $11,000 for the stock plus about $131 for commission. If he is correct and CDA rises to $30 he can sell out for $15,000 minus $157 commission, for a net profit of $3712 or about 33% of his initial investment. On the other hand, with $11,000 he could have bought at least 30 CDA calls exercisable at $20. If the stock went to $30 before the options expired, they would have an intrinsic value of $10 per share, plus whatever time value might be left, for a profit of at least $18,993, including commissions. This represents a return on the original investment of 178%, or 5.4 times the return obtained by buying the stock itself. If instead of buying calls exercisable at $20, those exercisable at $25 were bought, the return would be far greater. In this case about 88 calls could be bought, and if the stock went to $30 before expiration, a profit of about $32,048 would be realized after commissions.

Let us examine the other side of the coin. Unfortunately, coins such as these always seem to have another side. If our hero is wrong and CDA remains at $22, he has lost nothing except commissions if he chooses to buy the stock. If he buys the 30 calls exercisable at $20, he ends up just before expiration with calls worth only $2 per share, certainly less than he paid for them, and probably loses about $4871, including commissions. If, on the other hand, he went for broke and bought the 88 calls exercisable at $25, he would be precisely that, broke. The options exercisable at $25 are worthless on expiration day if the stock is selling at less than $25. Buying options instead of the stock gives the investor leverage, but leverage cuts both ways.

At this point our imaginary investor, who has been reading these lines, has a flash of genius. He will buy only 5 calls and will invest the remainder in a bond or other interest bearing instrument. He then has options on the same amount of stock that he otherwise would have bought, and therefore has the same upside potential for profit, but has limited his possible losses to certainly no more than the cost of the options plus commissions. Working out the details we find that the purchase of 5 calls with exercise prices of $20 and $25 results in costs of $1798 and $663, respectively; net profits of 174% and 260%, if the stock rises to $30 before expiration, otherwise losses limited in any case to the initial investment. Of course, the interest on the remaining $9180 or $10,320, as the case may be, is a profit in any event.

Table I summarizes the results of the 5 strategies discussed above for final stock prices of $14, $22 and $30. Since it is always more profitable to sell rather than exercise the option since commissions are less, the profits in the table were computed on this basis. Note in particular, that in every case, if the stock price remains unchanged at $22, a loss results. This is, of course, due to the inevitable, omnipresent and inescapable commissions.

Having seen how one can buy call options with the potential for a sizeable profit if the stock advances while at the same time limiting our possible losses to the cost of the options plus commissions, a further refinement be-

It is easily possible to double your investment in a few days; it is just as easy to halve it as quickly.

comes fairly obvious. Suppose our man invests all his funds (the whole $11,000) in an interest bearing security, and uses the interest to buy call options. Barring bankruptcies, the worst that can happen is for the options to expire worthless, in which case nothing is lost. If, on the other hand, the price of the stock underlying the options moves above the exercise price the profit could very easily amount to several times the initial investment.

Sounds great, doesn't it? Unfortunately, it is a losing game. First of all, bonds return your money unappreciated. True, you do get x% interest, whereas inflation is eating your money away at y%, where y is very likely to exceed x. On top of that you are using your interest to buy call options, which itself is a losing game as discussed previously. Just keeping the interest would be an improvement, and not investing in fixed value securities would be a further improvement.

The subject of option strategies is vast and only a beginning has been made. In the next 4 articles, a broad range of strategies will be explored as they become relevant to the investment programs to be discussed. □

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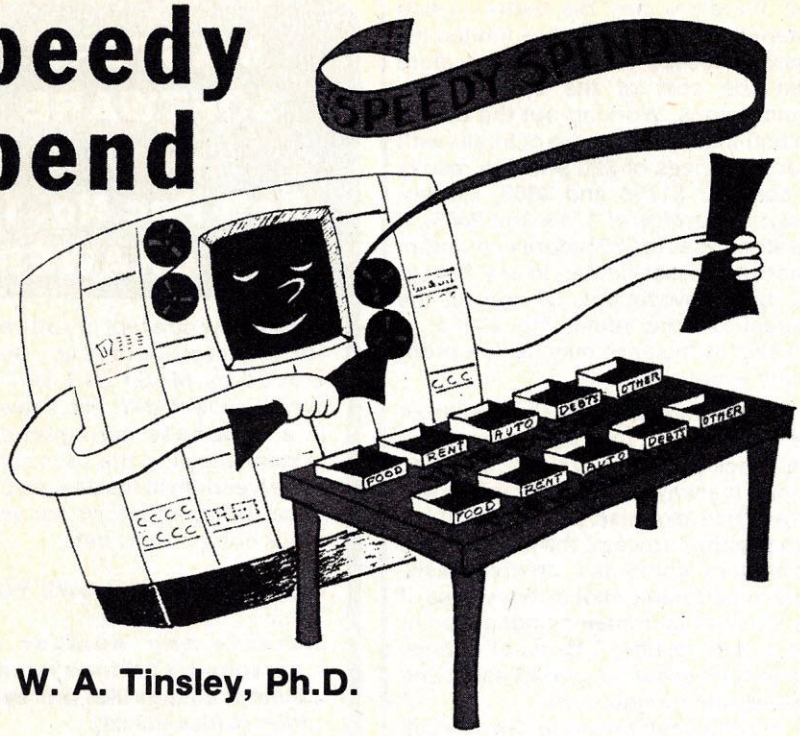

W. A. Tinsley, Ph.D.

You are sitting in your office in a fashionable shopping center in Atlanta armed with your microcomputer, two chairs, three space photos and a picture of Gustav Mahler. Your clients are people who have been through at least a dozen years of mathematics classes which trained them to be little calculating machines, but they never learned what to analyze or how. Consequently, they believe in the American dream that anyone can own anything and that there is no tomorrow as far as credit is concerned.

Your job is to help people place their financial circumstances in perspective. To do this, you've written several computer programs. A very useful one is based on the notion that if you know how many take-home dollars a family has to use each month, the number of persons in the family, and some information about what the family spends for the big monthly expenditures, then you can guess fairly closely as to how the family will spend the rest of the money. Table 1 contains your rules and assumptions used to "juggle" the budgets. You have found that it's easy to periodically revise these rules to adjust to price changes. You also have a provision in your computer program that allows the client to set maximum, minimum, or absolute values to be placed in each budget category.

Your input form is quite simple. You just ask your client for ten bits of information, switch on your computer, and in three minutes you are involved in some relevant financial counseling.

W. A. Tinsley, Ph.D., College of Agricultural Sciences, Clemson University, Clemson, SC 29631.

Dream House or Nightmare?

The day's first clients drop by. We'll call them the "dreamers." They have found their dream home, and want to know if they can afford it. Will it be a dream house or a nightmare?

The couple are in their late 30's. The husband has his own successful business. There are two children in the family, ages 7 and 11. The wife does not work outside the home.

The couple is about to buy a $90,000 home. They have previously accumulated equity of $30,000 in another home and are considering borrowing $60,000 to be repaid over 30 years at 11% interest. The mortgage payment on that amount is $571.39. In addition, the couple would probably need $90 or more per month for house taxes and insurance, making the total $651.33.

The husband has an income of $31,263 per year. After taxes and retirement deductions, his monthly take-home pay is $1657. You use the computer program to create a trial budget for the family (see Figure 1). Can they afford the new house? Perhaps, if they are willing to live with the "new house, no furniture, old car, peanut butter sandwich phenomenon."

The Wife Who Wants to Quit her Job

The second client is a junior high art teacher who is considering resigning her teaching job to give private art lessons. The important issue concerns how well the family would fare in a transitional period without her teaching income.

The first step is to do a careful analysis of how much of her teaching income actually shows up as take-home pay. You begin by using another computer program that calculates income taxes and figure the taxes on the combined salaries of the husband and wife and then the taxes on the husband's salary alone. Then you subtract other deductions from the wife's income such as retirement, professional dues, cost of extra household help, extra meals eaten out and transportation costs. Your client is surprised to find that she is only able to keep about $1 in $3 from her gross teaching income.

Estimates of your client's family budget picture with and without her school salary are shown in Figures 2 and 3. Your client leaves, leaning toward going into private business.

RULES USED IN DETERMINING THE MAXIMUM AND MINIMUM AMOUNTS ALLOWED FOR "YOUR BUDGET" AND THE "COMPARATIVE BUDGET"

THE INITIAL AMOUNTS PLACED IN THE BUDGETS ARE BASED ON THE PERCENTAGES LISTED IN THE ARRAY "S."

CATEGORY	"YOUR" BUDGET RULES	"COMPARATIVE" BUDGET RULES
1. Food	Use the figure the user supplies.	If the annual take-home pay is less than or equal to $7,500, allow a maximum of $87 for a one-person household; $57.60 per person for households of two persons or more. If take-home pay is $7,501-$15,500, use $115 for a one-person household, $72 per person for households of two or more persons. If take-home pay is $15,501 and above, allow $144 for a one-person household; $87 per person for households of two or more persons.
2. Rent or mortgage including house taxes and house insurance	Use the figure the user supplies.	Use the figure the user supplies.
3. Utilities	Use the user's figure.	Use 85% of the user's figure.
4. Car payment	Use the user's figure.	Take-home Pay / Formula Used Less than or equal to $15,500 — If one car, use $150; if more than one car, use $75 times the number of cars owned. Greater than $15,500 — If one car, use $250; if more than one car, use $125 times the number of cars owned.
5. Gas and oil	Maximum used is $60 per car per month. Minimum used is $40 per car per month.	Same as for "Your Budget"
6. Car upkeep	Maximum amount is $40 per car per month; minimum used is $25 per car per month. If there are car payments, the maximum is $32 per car.	Same as for "Your Budget"

CATEGORY	"YOUR" BUDGET RULES	"COMPARATIVE" BUDGET RULES
7. Car, insurance, licenses, etc.	Maximum amount is $35 per car per month. Minimum amount is $20 per car per month.	Same as for "Your Budget"
8. Other debts	Use user's figure.	Maximum allowed is 10% of take-home pay.
9. Clothing	Maximum is $45 for the first person in the family and $25 for each additional family member. Minimum is $10 per person per month.	Same as for "Your Budget"
10. Life insurance	If take-home pay is $12,000 per year or less, the maximum allowed is $5 per month per person in the household. If take-home pay is above $12,000, the maximum is $20 per household member per month.	Same as "Your Budget"
11. Doctor & medical	Maximum is $15 per month per person. Minimum is $7 per month per person.	Same as "Your Budget"
12. Furnishings & equipment	Maximum is $300 per month. Minimum is $5 per month.	Same as "Your Budget"
13. General supplies	Maximum is $20 per month for the first person in the household, plus $15 per person for each additional member. Minimum is $10 for the first family member plus $5 for each additional member.	Same as "Your Budget"
14. Education	Maximum is $15 per month for the first person in the household, plus $8 per person for each additional member. Minimum is $10 for the first person and $5 for each additional family member.	Same as "Your Budget"
15. Gifts and contributuons	Maximum is 12% of take-home pay. Minimum is 2% or take-home pay.	Same as "Your Budget"
16. Recreation	Maximum is 15% of take-home pay. Minimum is $8 per person per month.	Same as "Your Budget"
17. Personal	Maximum is $30 per month for the first person, plus $10 per month for each additional person. Minimum is $5 per person per month.	Same as "Your Budget"
18. Savings and Investments	No maximum; savings may be negative indicating that money must be borrowed or taken from savings.	Same as "Your Budget"
19. Child Care, Alimony, Household Help, and Other	Use user's figure.	No maximum or minimum

RULES GOVERNING THE APPEARANCE OF COMMENTS STATEMENTS

1. All users get the statement, "An estimated _xx_% or $____ of your budget goes for food, housing, auto, and 'other' debt."
2. All users get the statement, "This leaves _xx_% or $____ to decide about."
3. The following statements depend upon the user's results:
   a. If savings are estimated to be negative (user is likely to spend more than is said to be available), the following statement is printed: "We guess that you will need $_____ from savings or from a loan to get by each month."
   b. If the percentage estimated in the "Your Budget" column going for food, housing, auto costs, and "other" debt is greater than 70% or if the estimated dollar amount left after paying these expenses is less than $200, the following statement is printed: "You need careful planning to get by on your budget."
   c. If the percentage in the "Your Budget" column estimated as going for food, housing, auto expenses, and "other" debt is less than 55%, the following statement is printed: "Congratulations--you are better off than most."
   d. If the user's monthly food budget is more than $50 higher than the "Comparative Budget" figure, the following statement is printed: "You may be able to reduce your food budget."
   e. If the user's car payments are $50 more per month than the figure in the "Comparative Budget," the following statement is printed: "You might find some way to cut car costs."
   f. If the percentage spent by the user on "other" debts is more than 10% higher than the percentage listed in the "Comparative Budget" column, the following statement is printed: "Your Other Debt Needs to be Reduced."

TABLE 1

ESTIMATED EXPENDITURE PERCENTAGES BY INCOME LEVEL[1]

Category	Annual Take-Home Pay: Less Than $5,000	5,001-7,500	7,501-12,000	12,001-15,500	15,501-19,000	19,000+
1. Food	30	23	21	18	18	16
2. Rent or Mortgage, House Taxes, and Home Insurance	27	21	20	20	20	17
3. Utilities	15	13	11	10	9	7
4. Car Payment	0	12	12	12	12	8
5. Gas and Oil	4	6	7	5	5	6
6. Car Upkeep	3	3	3	2	2	2
7. Car Insurance	3	3	3	3	3	3
8. Other Debts	7	7	7	8	7	7
9. Clothing	2	3	3	4	4	6
10. Life Insurance	1	1	2	2	3	2
11. Doctor and Medical	2	2	3	3	3	4
12. Furnishings and Equipment	1	1	1	2	3	1
13. General Supplies	1	1	1	1	1	1
14. Education	1	1	1	1	1	1
15. Gifts and Contributions	1	1	2	4	4	5
16. Recreation	1	1	2	4	4	5
17. Personal	1	1	1	1	1	1
18. Savings and Investment	0	0	0	0	0	8
19. Other Expenses	0	0	0	0	0	0

[1] The percentages actually used for food, housing, and utilities are not the ones shown in this table. The figures in this table should be considered as relative weights used in allocating funds among the categories listed on lines 4 through 18.

A Budget for the Jet Set

Next, your day is considerably brightened by the unexpected arrival of a ravishing beauty currently married to a famous rock star. She is in Atlanta on a shopping tour, but is also conferring with her lawyer about the terms of an impending divorce. She is concerned about settlement terms and wants to know how she and her small daughter will fare on her new budget.

She feels she needs $1500 a month for food and parties, $4000 per month for housing, $2000 per month for car payments, $800 per month for clothing, and $1500 per month for travel and recreation. Her lawyer is asking for $11,000 per month to cover her living needs. Will she be able to survive, or should she ask for more? You be the judge. See Figure 4.

A dozen years of mathematics classes trained them to be little calculating machines, but they never learned what to analyze or how.

The Minimum Wage Blues

Finally, a high school senior drops by, attracted by your space age office and computer. He plans to skip college, take a minimum wage job, and enjoy the easy life in Atlanta. His initial take-home pay will be $480 per month.

He figures he needs $150 per month for a shared apartment and $75 per month for a cheap car. You point out some of his other expenses (see Figure 5). He begins to get the big picture and leaves to reconsider the whole bleak situation. Maybe a *Foxfire* book and a move to the Georgia mountains would be more feasible.

Computers Can Help Focus on Spending Alternatives

There are hundreds of interesting stories in the financial counseling business. Tomorrow someone will probably come by who's been offered a new job and a $15,000 raise to move to Chicago. After income taxes and other increased costs, will the move be worth it? You and your microcomputer can soon come close to pinpointing the after-move realities.

Everyone feels that their financial situation is very unique. You know that there aren't many differences. Everyone is worse off than they think, and eight out of ten people are in the dark when it comes to evaluating financial alternatives. Despite the simplicity of it all, your microcomputer results offer a veritable shining light amid the darkness and a first step toward more reasonable choices. □

Speedy, cont'd...

Speedy Spend

What is "Speedy Spend?" Would you like to have your budget analyzed by "Speedy Spend?" You may be wondering what it all means — how **does** the computer do it?

Think of the computer as if it were a person who wants to help you. First tell that person how much you are spending for certain things, such as food, housing, and car payments. Pretend to give the person your pay envelope (take-home pay). Now look at an imaginary table and see twenty small boxes each labeled a different expense. One is marked "food" another is marked "utilities" and so forth down the line. These boxes represent all of the things you spend your money on every month, including a box for "savings and investments."

Quickly, the person (computer) begins to put money into each box. He follows your directions for food, car payments, rent (or mortgage), utilities, installment debts, and other (this box stands for many things such as child care, household help, alimony, taxi or bus fare). If you have any money left over, he will put it into all the other little boxes. Some will go into "doctor and medical," a few dollars more may be placed into "life insurance," or "gifts and contributions." Pretty soon all of your paycheck will be divided into one of the twenty boxes. Now your budget is balanced.

But the computer doesn't stop there. Look now behind the first row of boxes and see a second set of imaginary boxes. These boxes represent a "Typical Budget" for a South Carolina family with the same income and size as your family.

Now your helper begins again to place money into the boxes. We have learned how others spend their money by collecting information at exhibits and through the mail from people like you. We keep all information strictly confidential. No names are ever revealed.

You will probably want to compare your budget with the "Typical Budget." Look at the boxes marked "food," "car payments," "rent or mortgage," "utilities," "installment debts," and "other." Do your boxes have more or less in them than the other set? If, in total, you are putting more money into these boxes, you will notice that you have less available to go into the fourteen other categories. If you are spending less, the other fourteen boxes will have bigger stacks in them.

Your "Speedy Spend" results are like the steps just described, except that a computer budgets your income rather than a person. The computer has a very complicated list of instructions as to how much money to allow for each category. Many of those instructions depend on how many people are in your family, how many cars you have, and your income level. It would take a human several hours to do the same work that the computer does in a fraction of a second.

Maybe you won't like the way the computer divides **YOUR BUDGET**. Maybe you want to take some of the money out of the recreation box and put it into clothing. Maybe you don't need as much for property taxes and want to use some of that money for additional gas and oil. Make whatever changes the family would like to make. The computer has given you a head start. It's easier to re-do your computer budget than to start from scratch.

Suppose you want to go a step further. Do this — think over how much you need per month for each item in your budget. Some months you will need more money. Persons who are paid every other week usually get two paychecks in a given month, but in a couple of months during the year they get paid three times.

This monthly change in income and expenses can be tricky. It may be helpful to map out your spending needs for the next 12 months. This can also be done by computer. Fill out the "Computer Form," HM Leaflet 533. Use your **Speedy Spend** results as a guide. Follow directions on the form and mail it to Clemson. In return, you'll receive a 12-month spending plan which can highlight the ups and downs in your budget.

Better spending choices can come from knowing more about your budget. Clemson can help you discover more of the things you need to know to make better choices. Don't stop now. Fill out the computer form and return it to Clemson for a clearer picture of where you are and where you can be going with your take home dollars.

Name or S. S. No. _____

Address _____

City _____ **State** _____ **Zip** _____

☐ 1. Number of people in your family?

☐ 2. Number of cars in your family?

☐ 3. Available take-home pay each pay period?

☐ 4. Enter 52 if you are paid weekly; 26 if twice a month; 12 if monthly or 1 if yearly.

Monthly Estimates

☐ 5. FOOD

☐ 6. CAR PAYMENTS

☐ 7. RENT OR MORTGAGE

☐ 8. UTILITIES (heat, electricity, phone, etc.)

☐ 9. INSTALLMENT DEBTS WITH INTEREST DUE EACH MO. (Sears, Master Charge, Loan Companies, and others.)

☐ 10. OTHER (including child care, household help, alimony, taxi, and bus)

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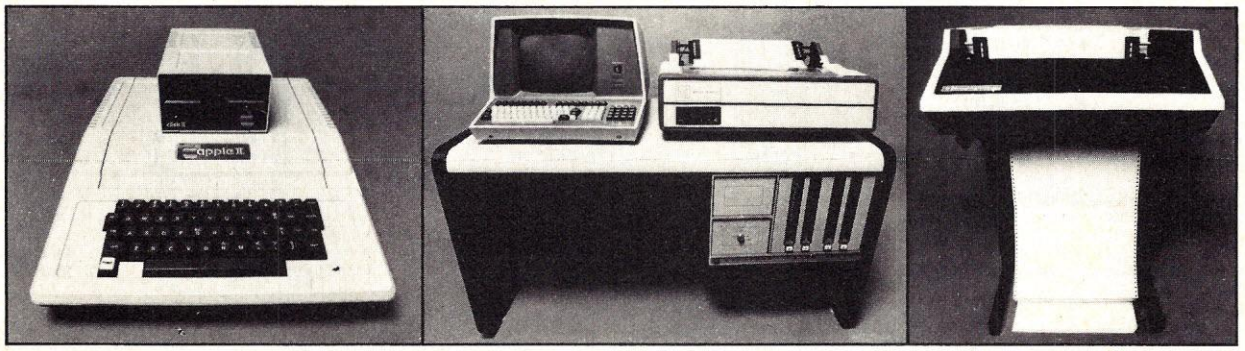


SUNSHINE COMPUTER COMPANY
The Sensible Alternative.

Speedy, cont'd...

DREAMERS, YOU SAY YOU HAVE $ 1,657.00 PER MONTH TO USE.
YOU ARE USING $ 1,386.33 FOR THE FOLLOWING:

FOOD	$	360.00
CAR PAYMENTS	$	175.00
RENT(MORTGAGE)	$	651.33
UTILITIES	$	125.00
OTHER DEBT PAYMENTS	$	75.00
CHILDCARE, OTHER	$	0.00

SO FAR SO GOOD, THERE IS $ 270.67 LEFT TO SPEND

WE HAVE JUGGLED YOUR MONTHLY BUDGET.
HERE ARE OUR GUESSES AND COMPARISONS.

* * *
COMPARATIVE MONTHLY BUDGET ANALYSIS

ITEM	YOUR BUDGET DOLLARS	PERCENT	COMPARATIVE BUDGET DOLLARS	PERCENT
TAKE HOME PAY	1,657.00		1,657.00	
EXPENSES				
FOOD	360.00	21.73	348.00	21.00
RENT OR MORTGAGE	651.33	39.31	651.33	39.31
UTILITIES	125.00	7.54	106.25	6.41
CAR PAYMENT	175.00	10.56	73.52	4.44
GAS AND OIL	80.00	4.83	80.00	4.83
CAR UPKEEP	50.00	3.02	50.00	3.02
CAR INS, LICENSE,ETC	40.00	2.41	40.00	2.41
OTHER DEBTS	75.00	4.53	0.00	0.00
CLOTHING	40.00	2.41	55.14	3.33
LIFE INSURANCE	20.00	1.21	18.38	1.11
DOCTOR AND MEDICAL	28.00	1.69	36.76	2.22
FURNISHINGS & EQUIP	6.01	0.36	9.19	0.55
GENERAL SUPPLIES	25.00	1.51	9.19	0.55
EDUCATION	25.00	1.51	9.19	0.55
GIFTS, CONTRIBUTIONS	33.14	2.00	30.57	1.84
RECREATION	32.00	1.93	45.95	2.77
PERSONAL	20.00	1.21	20.00	1.21
CHILDCARE, OTHER	0.00	0.00	0.00	0.00
SAVINGS	-128.48	-7.75	73.52	4.44
TOTALS	1,657.00	100.00	1,657.00	100.00

MONEY CAN BUY MORE IF YOU PLAN

COMMENTS
AN ESTIMATED 93.92% OR $1556.33 OF YOUR BUDGET
GOES FOR FOOD, HOUSING, AUTO & OTHER DEBT.
THIS LEAVES 6.08% OR $ 100.67 TO DECIDE ABOUT.
YOU NEED CAREFUL PLANNING TO GET BY ON YOUR BUDGET.
WE GUESS YOU WILL NEED $ 128.48 FROM SAVINGS.
OR FROM A LOAN TO GET BY EACH MONTH.
YOU MIGHT CUT CAR COST.

STAY WITH IT DREAMERS

FIGURE 1

WIFE WORKS, YOU SAY YOU HAVE $ 2,330.00 PER MONTH TO USE.
YOU ARE USING $ 1,518.00 FOR THE FOLLOWING:

FOOD	$	450.00
CAR PAYMENTS	$	144.00
RENT(MORTGAGE)	$	400.00
UTILITIES	$	150.00
OTHER DEBT PAYMENTS	$	324.00
CHILDCARE, OTHER	$	50.00

SO FAR SO GOOD, THERE IS $ 812.00 LEFT TO SPEND

WE HAVE JUGGLED YOUR MONTHLY BUDGET.
HERE ARE OUR GUESSES AND COMPARISONS.

* * *
COMPARATIVE MONTHLY BUDGET ANALYSIS

ITEM	YOUR BUDGET DOLLARS	PERCENT	COMPARATIVE BUDGET DOLLARS	PERCENT
TAKE HOME PAY	2,330.00		2,330.00	
EXPENSES				
FOOD	450.00	19.31	348.00	14.94
RENT OR MORTGAGE	400.00	17.17	400.00	17.17
UTILITIES	150.00	6.44	127.50	5.47
CAR PAYMENT	144.00	6.18	211.29	9.07
GAS AND OIL	108.27	4.65	120.00	5.15
CAR UPKEEP	50.00	2.15	54.47	2.34
CAR INS, LICENSE,ETC	54.13	2.32	70.00	3.00
OTHER DEBTS	324.00	13.91	184.88	7.93
CLOTHING	108.27	4.65	120.00	5.15
LIFE INSURANCE	36.09	1.55	52.82	2.27
DOCTOR AND MEDICAL	60.00	2.58	60.00	2.58
FURNISHINGS & EQUIP	18.04	0.77	26.41	1.13
GENERAL SUPPLIES	25.00	1.07	26.41	1.13
EDUCATION	25.00	1.07	26.41	1.13
GIFTS, CONTRIBUTIONS	90.22	3.87	132.05	5.67
RECREATION	90.22	3.87	132.05	5.67
PERSONAL	20.00	0.86	26.41	1.13
CHILDCARE, OTHER	50.00	2.15	0.00	0.00
SAVINGS	126.76	5.44	211.29	9.07
TOTALS	2,330.00	100.00	2,330.00	100.00

MONEY CAN BUY MORE IF YOU PLAN

COMMENTS
AN ESTIMATED 72.12% OR $1680.40 OF YOUR BUDGET
GOES FOR FOOD, HOUSING, AUTO & OTHER DEBT.
THIS LEAVES 27.88% OR $ 649.60 TO DECIDE ABOUT.
YOU NEED CAREFUL PLANNING TO GET BY ON YOUR BUDGET.
YOU MAY BE ABLE TO REDUCE YOUR FOOD BUDGET.

STAY WITH IT WIFE WORKS

FIGURE 2

FIGURE 3

WIFE DOESN'T WORK, YOU SAY YOU HAVE $ 1,950.00 PER MONTH TO USE.
YOU ARE USING $ 1,200.00 FOR THE FOLLOWING:

FOOD	$	400.00
CAR PAYMENTS	$	90.00
RENT(MORTGAGE)	$	400.00
UTILITIES	$	160.00
OTHER DEBT PAYMENTS	$	150.00
CHILDCARE, OTHER	$	0.00

SO FAR SO GOOD, THERE IS $ 750.00 LEFT TO SPEND

WE HAVE JUGGLED YOUR MONTHLY BUDGET.
HERE ARE OUR GUESSES AND COMPARISONS.

* * *
COMPARATIVE MONTHLY BUDGET ANALYSIS

ITEM	YOUR BUDGET DOLLARS	PERCENT	COMPARATIVE BUDGET DOLLARS	PERCENT
TAKE HOME PAY	1,950.00		1,950.00	
EXPENSES				
FOOD	400.00	20.51	348.00	17.85
RENT OR MORTGAGE	400.00	20.51	400.00	20.51
UTILITIES	160.00	8.21	136.00	6.97
CAR PAYMENT	90.00	4.62	142.13	7.29
GAS AND OIL	100.00	5.13	106.60	5.47
CAR UPKEEP	50.00	2.56	50.00	2.56
CAR INS, LICENSE,ETC	50.00	2.56	53.30	2.73
OTHER DEBTS	150.00	7.69	118.73	6.09
CLOTHING	100.00	5.13	106.60	5.47
LIFE INSURANCE	33.33	1.71	35.53	1.82
DOCTOR AND MEDICAL	60.00	3.08	60.00	3.08
FURNISHINGS & EQUIP	16.67	0.85	17.77	0.91
GENERAL SUPPLIES	25.00	1.28	17.77	0.91
EDUCATION	25.00	1.28	17.77	0.91
GIFTS, CONTRIBUTIONS	83.33	4.27	88.83	4.56
RECREATION	83.33	4.27	88.83	4.56
PERSONAL	20.00	1.03	20.00	1.03
CHILDCARE, OTHER	0.00	0.00	0.00	0.00
SAVINGS	103.33	5.30	142.13	7.29
TOTALS	1,950.00	100.00	1,950.00	100.00

MONEY CAN BUY MORE IF YOU PLAN

COMMENTS
AN ESTIMATED 71.79% OR $1400.00 OF YOUR BUDGET
GOES FOR FOOD, HOUSING, AUTO & OTHER DEBT.
THIS LEAVES 28.21% OR $ 550.00 TO DECIDE ABOUT.
YOU NEED CAREFUL PLANNING TO GET BY ON YOUR BUDGET.
YOU MAY BE ABLE TO REDUCE YOUR FOOD BUDGET.

STAY WITH IT WIFE DOESN'T WORK

Back, and Bigger than Ever.

NCC Personal Computing Festival

May 20-22, Disneyland Hotel

So great is the interest in personal computing, so dynamic is the personal computer industry, that this year's Personal Computing Festival is again being held separate from the rest of NCC, at the Disneyland Hotel.

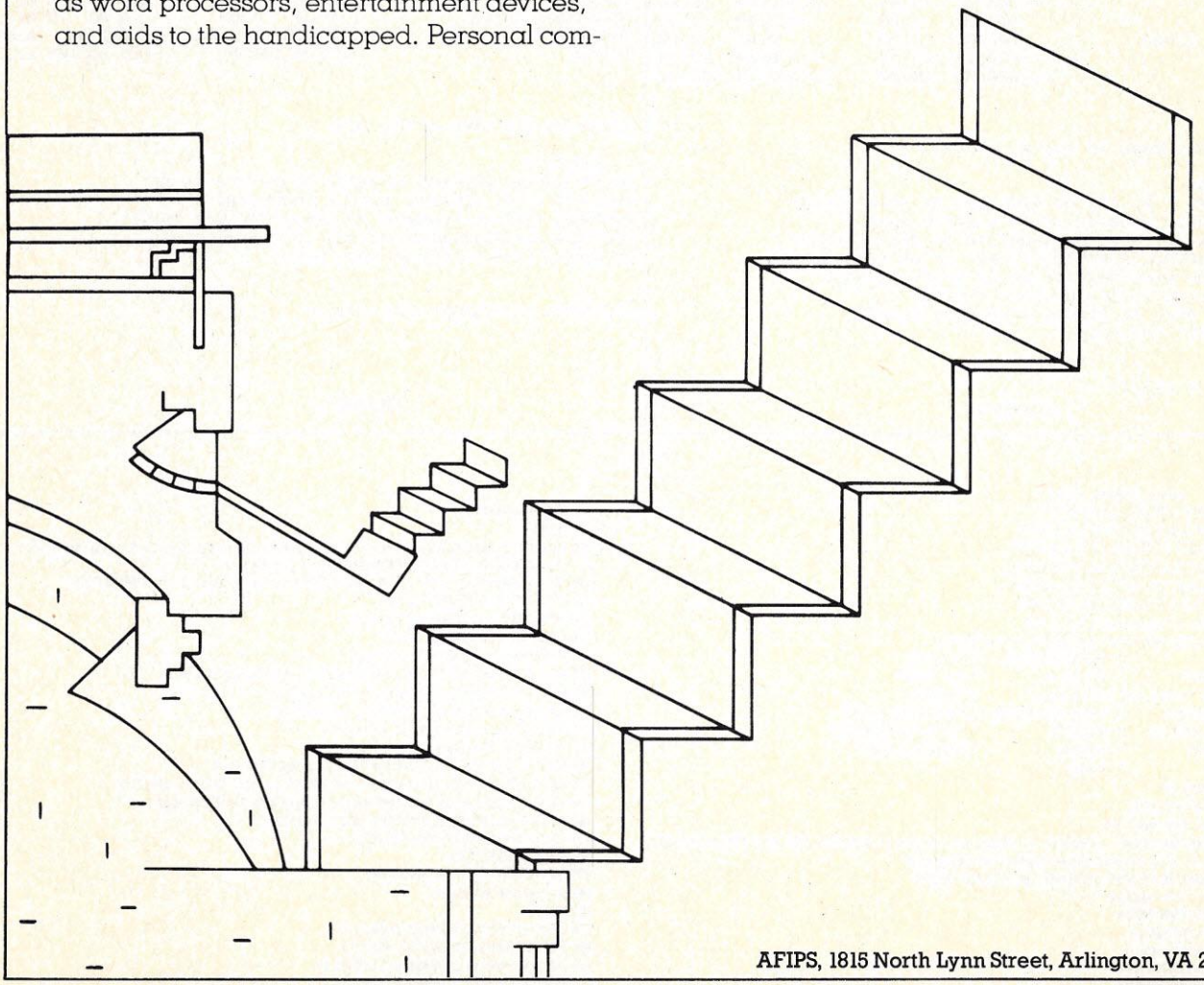
The 3-day festival features its own impressive roster of exhibitors plus over 50 learning sessions on every aspect of personal computers and their use.

Personal computers at home, at school, and in the executive suite. Personal computers as word processors, entertainment devices, and aids to the handicapped. Personal computer operating systems, programming languages, and software evaluation.

In addition, we've set aside a special area where demonstrations of personal computers will be conducted throughout the show. And we're awarding prizes for the most interesting use of personal computers.

If you're coming to NCC '80, be sure to make The Personal Computing Festival part of your visit.

Who knows—you may even win a prize.



AFIPS, 1815 North Lynn Street, Arlington, VA 22209

Speedy, cont'd...

```
BEAUTY, YOU SAY YOU HAVE $ 11,000.00 PER MONTH TO USE.
YOU ARE USING $  9,150.00 FOR THE FOLLOWING:

FOOD                  $  1,500.00
CAR PAYMENTS          $  2,000.00
RENT(MORTGAGE)        $  4,000.00
UTILITIES             $    650.00
OTHER DEBT PAYMENTS $      500.00
CHILDCARE, OTHER      $    500.00
SO FAR SO GOOD, THERE IS $  1,850.00 LEFT TO SPEND

WE HAVE JUGGLED YOUR MONTHLY BUDGET.
HERE ARE OUR GUESSES AND COMPARISONS.

                *             *             *
          COMPARATIVE MONTHLY BUDGET ANALYSIS
-------------------------------------------------------------------
                          YOUR BUDGET   COMPARATIVE BUDGET
ITEM                    DOLLARS PERCENT   DOLLARS PERCENT
-------------------------------------------------------------------
 TAKE HOME PAY          11,000.00         11,000.00

  EXPENSES
FOOD                     1,500.00  13.64     174.00   1.58
RENT OR MORTGAGE         4,000.00  36.36   4,000.00  36.36
UTILITIES                  650.00   5.91     552.50   5.02
CAR PAYMENT              2,000.00  18.18     250.00   2.27
GAS AND OIL                150.00   1.36     150.00   1.36
CAR UPKEEP                  82.22   0.75     110.00   1.00
CAR INS, LICENSE,ETC        70.00   0.64      70.00   0.64
OTHER DEBTS                500.00   4.55   1,004.03   9.13
CLOTHING                   800.00   7.27   1,097.44   9.98
LIFE INSURANCE             100.00   0.91     100.00   0.91
DOCTOR AND MEDICAL         100.00   0.91     100.00   0.91
FURNISHINGS & EQUIP         50.00   0.45     143.43   1.30
GENERAL SUPPLIES            50.00   0.45      50.00   0.45
EDUCATION                   50.00   0.45      50.00   0.45
GIFTS, CONTRIBUTIONS       300.00   2.73     300.00   2.73
RECREATION               1,500.00  13.64   1,500.00  13.64
PERSONAL                   200.00   1.82     200.00   1.82
CHILDCARE, OTHER           500.00   4.55       0.00   0.00
SAVINGS                 -1,602.22 -14.57   1,148.60  10.44
TOTALS                  11,000.00 100.00  11,000.00 100.00


MONEY CAN BUY MORE IF YOU PLAN

   COMMENTS
AN ESTIMATED   81.38% OR $8952.22 OF YOUR BUDGET
GOES FOR FOOD, HOUSING, AUTO & OTHER DEBT.
THIS LEAVES   18.62% OR $2047.78 TO DECIDE ABOUT.
YOU NEED CAREFUL PLANNING TO GET BY ON YOUR BUDGET.
WE GUESS YOU WILL NEED $1602.22 FROM SAVINGS.
OR FROM A LOAN TO GET BY EACH MONTH.
YOU MAY BE ABLE TO REDUCE YOUR FOOD BUDGET.
YOU MIGHT CUT CAR COST.


STAY WITH IT BEAUTY
```

FIGURE 4

```
MINIMUM WAGE SINGLE, YOU SAY YOU HAVE $    625.00 PER MONTH TO USE.
YOU ARE USING $       0.00 FOR THE FOLLOWING:

FOOD                  $       0.00
CAR PAYMENTS          $       0.00
RENT(MORTGAGE)        $       0.00
UTILITIES             $       0.00
OTHER DEBT PAYMENTS $         0.00
CHILDCARE, OTHER      $       0.00
SO FAR SO GOOD, THERE IS $    625.00 LEFT TO SPEND

WE HAVE JUGGLED YOUR MONTHLY BUDGET.
HERE ARE OUR GUESSES AND COMPARISONS.

                *             *             *
          COMPARATIVE MONTHLY BUDGET ANALYSIS
-------------------------------------------------------------------
                          YOUR BUDGET   COMPARATIVE BUDGET
ITEM                    DOLLARS PERCENT   DOLLARS PERCENT
-------------------------------------------------------------------
 TAKE HOME PAY            625.00            625.00

  EXPENSES
FOOD                       0.00   0.00   6,912.00 1105.92
RENT OR MORTGAGE           0.00   0.00       0.00    0.00
UTILITIES                  0.00   0.00       0.00    0.00
CAR PAYMENT                0.00   0.00       0.00    0.00
GAS AND OIL            3,000.00 480.00   3,000.00  480.00
CAR UPKEEP             1,875.00 300.00   1,875.00  300.00
CAR INS, LICENSE,ETC   1,500.00 240.00   1,500.00  240.00
OTHER DEBTS                0.00   0.00       0.00    0.00
CLOTHING               1,200.00 192.00   1,200.00  192.00
LIFE INSURANCE           600.00  96.00       5.00    0.80
DOCTOR AND MEDICAL       840.00 134.40     840.00  134.40
FURNISHINGS & EQUIP       26.04   4.17       5.00    0.80
GENERAL SUPPLIES         605.00  96.80       5.00    0.80
EDUCATION                605.00  96.80       5.00    0.80
GIFTS, CONTRIBUTIONS      26.04   4.17       0.00    0.00
RECREATION               960.00 153.60     960.00  153.60
PERSONAL                 600.00  96.00     600.00   96.00
CHILDCARE, OTHER           0.00   0.00       0.00    0.00
SAVINGS                -11.212.10%-1793.93 -16,282.00    0.00
TOTALS                   625.00 100.00     625.00 2705.12


MONEY CAN BUY MORE IF YOU PLAN

   COMMENTS
AN ESTIMATED 1020.00% OR $6375.00 OF YOUR BUDGET
GOES FOR FOOD, HOUSING, AUTO & OTHER DEBT.
YOU NEED CAREFUL PLANNING TO GET BY ON YOUR BUDGET.
WE GUESS YOU WILL NEED $%11212.10 FROM SAVINGS.
OR FROM A LOAN TO GET BY EACH MONTH.


STAY WITH IT MINIMUM WAGE SINGLE
```

FIGURE 5

Listing 1

```
10 REM            ****** SPEEDY ******
20 DIMS(19,6),BD(20,6),T$(20),X(10),0(20)
30 DATA30,27,15,8,4,3,3,7,2,1,2,1,1,1,1,1,0,0
40 DATA23,21,13,12,6,3,3,7,3,1,2,1,1,1,1,1,0,0
50 DATA21,20,11,12,7,3,3,7,3,2,3,1,1,1,2,2,1,0,0
60 DATA18,20,10,12,5,2,3,8,4,2,3,2,1,1,3,4,1,0,0
70 DATA18,20,9,12,5,2,3,7,4,3,3,3,1,1,4,4,1,0,0
80 DATA16,17,7,8,6,2,3,7,6,2,4,1,1,1,5,5,1,0,8
90 FORJ=1TO6:FORI=1TO19:READS(I,J):S(I,J)=S(I,J)/100:NEXTI,J
100 DATA "FOOD              ","RENT OR MORTGAGE    ","UTILITIES          "
110 DATA "CAR PAYMENT       ","GAS AND OIL        ","CAR UPKEEP         "
120 DATA "CAR INS, LICENSE,ETC","OTHER DEBTS      ","CLOTHING           "
130 DATA "LIFE INSURANCE    ","DOCTOR AND MEDICAL ","FURNISHINGS & EQUIP "
140 DATA "GENERAL SUPPLIES  ","EDUCATION          ","GIFTS, CONTRIBUTIONS"
150 DATA "RECREATION        ","PERSONAL           ","CHILDCARE, OTHER   "
160 DATA "SAVINGS           ","TOTALS             "
165 KK=0:H1$="#,#####.##"
170 FORI=1TO20:READT$(I):NEXTI
180 CLS:INPUT"ENTER YOUR NAME";NA$
190 INPUT"ENTER YOUR TEN FIGURES, SEPARATED BY COMMAS";X(1),X(2),X(3),X(4),X(5),X(6),X(7),X(8),X(9),X(10)
200 INPUT"IS DATA OK (Y OR N)";AN$:IFAN$="N"ORAN$="NO"THENGOTO190
205 PRINT@520,"PLERSE BE PATIENT--THERE WILL BE A SLIGHT DELAY"
206 PRINT@660,"! ! ! I'M  WORKING ! ! !"
210 Z=X(3)*X(4):IFZ<=5000THENM=1
220 IFZ>5000ANDZ<=7500THENM=2
230 IFZ>7500ANDZ<=12000THENM=3
240 IFZ>12000ANDZ<=15500THENM=4
250 IFZ>15500ANDZ<=19000THENM=5
260 IFZ>19000THENM=6
265 Z=Z/12
270 DN=S(5,M)+S(6,M)+S(7,M)+S(9,M)+S(10,M)+S(11,M)+S(12,M)+S(13,M)+S(14,M)+S(15,M)+S(16,M)+
    S(17,M)+S(19,M):IFX(2)=0THENDN=DN-S(6,M)-S(7,M)-S(5,M)
280 BD(1,1)=X(5):BD(2,1)=X(7):BD(3,1)=X(8):BD(4,1)=X(6):OT=X(1)-1:IFX(6)0THENGOTO415
290 IFM<=4ANDX(2)=1THENBD(4,2)=150
300 IFM<=4ANDX(2)>1THENBD(4,2)=X(2)*75
310 IFM>4ANDX(2)=1THENBD(4,2)=250
320 IFM>4ANDX(2)>1THENBD(4,2)=X(2)*125
330 BD(5,2)=X(2)*60:BD(5,3)=X(2)*40:BD(6,2)=X(2)*40:BD(6,3)=X(2)*25
340 BD(7,3)=X(2)*20:IFX(6)>0THENBD(5,2)=BD(6,2)*.8
350 BD(7,2)=X(2)*35:BD(8,2)=.1*Z:BD(9,2)=45+(OT*25)
360 BD(9,3)=X(1)*10:IFM<3BD(10,2)=X(1)*5
370 IFM>3BD(10,2)=X(1)*20
380 BD(11,2)=X(1)*15:BD(11,3)=X(1)*7:BD(12,2)=300:BD(12,3)=5
390 BD(13,2)=20+(OT*15):BD(14,2)=15+(OT*8):BD(15,2)=.12*Z:BD(14,3)=10+(OT*5)
400 BD(16,2)=.15*Z:BD(16,3)=X(1)*8:BD(17,2)=30+(OT*10):BD(15,3)=.02*Z
410 BD(17,3)=X(1)*5:BD(18,3)=X(1)*5:BD(13,3)=10+(OT*5)
415 RS=Z-X(5)-X(6)-X(7)-X(8)-X(9)-X(10)
420 IFRS<=0THENGOTO1360
430 FORI=9TO19:IFS(I,M)=0THENGOTO445
440 BD(I,1)=RS*(S(I,M)/DN)
445 NEXTI
450 IFBD(9,1)>BD(9,2)THENBD(9,1)=BD(9,2)
460 IFBD(9,1)<BD(9,3)THENBD(9,1)=BD(9,3)
470 IFBD(10,1)>BD(10,2)THENBD(10,1)=BD(10,2)
475 IFBD(10,1)<BD(10,3)THENBD(10,1)=BD(10,3)
```

Speedy, cont'd...

```
480 IFBD(13,1)>BD(13,2)THENBD(13,1)=BD(13,2)
485 IFBD(13,1)<BD(13,3)THENBD(13,1)=BD(13,3)
490 IFBD(14,1)>BD(14,2)THENBD(14,1)=BD(14,2)
495 IFBD(14,1)<BD(14,3)THENBD(14,1)=BD(14,3)
500 IFBD(15,1)>BD(15,2)THENBD(15,1)=BD(15,2)
505 IFBD(15,1)<BD(15,3)THENBD(15,1)=BD(15,3)
510 IFBD(16,1)>BD(16,2)THENBD(16,1)=BD(16,2)
520 IFBD(16,1)<BD(16,3)THENBD(16,1)=BD(16,3)
530 IFBD(17,1)>BD(17,2)THENBD(17,1)=BD(17,2)
540 IFBD(17,1)<BD(17,3)THENBD(17,1)=BD(17,3)
550 IFBD(12,1)>BD(12,2)THENBD(12,1)=BD(12,2)
560 IFBD(12,1)<BD(12,3)THENBD(12,1)=BD(12,3)
570 IFBD(11,1)>BD(11,2)THENBD(11,1)=BD(11,2)
580 IFBD(11,1)<BD(11,3)THENBD(11,1)=BD(11,3)
590 IFX(2)<=0THENGOTO630
610 FORI=5TO7:IFS(I,M)<=0THENGOTO625
620 BD(I,1)=RS*(S(I,M)/DN)
625 NEXT I
627 IFBD(6,1)>BD(6,2)THENBD(6,1)=BD(6,2)
630 IFBD(6,1)<BD(6,3)THENBD(6,1)=BD(6,3)
640 IFBD(7,1)>BD(7,2)THENBD(7,1)=BD(7,2)
650 IFBD(7,1)<BD(7,3)THENBD(7,1)=BD(7,3)
660 IFBD(5,1)>BD(5,2)THENBD(5,1)=BD(5,2)
670 IFBD(5,1)<BD(5,3)THENBD(5,1)=BD(5,3)
680 BD(8,1)=X(9):BD(18,1)=X(10)
700 ZP=Z:FORI=1TO19:ZP=ZP-BD(I,1):NEXTI
710 BD(19,1)=BD(19,1)+ZP:SG=0:IFBD(19,1)<0THENSG=1
720 FORI=1TO19:Q(I)=S(I,M):NEXTI:FORI=4TO7:IFX(2)=0THENQ(I)=0
730 NEXTI:IFX(6)=0THENQ(4)=0
740 Q(2)=BD(2,1)/Z:Q(3)=(BD(3,1)/Z)*.85:KO=0
750 IFMK=2THENQ(1)=X(1)*57.6
760 IFM=3ORM=4THENQ(1)=X(1)*72
770 IFM>4THENQ(1)=X(1)*87
780 IFMK=2ANDX(1)=1THENQ(1)=87
790 IFM=3ORM=4ANDX(1)=1THENQ(1)=115
800 IFM>4ANDX(1)=1THENQ(1)=144
810 BD(1,4)=Q(1):Q(1)=Q(1)/Z:DN=0:TT=0:FORI=1TO19:TT=TT+Q(I):NEXTI
820 FORI=4TO19:DN=DN+Q(I):NEXTI:SH=1-TT:FORI=4TO19:IFQ(I)=0THENGOTO835
830 Q(I)=((Q(I)/DN)*SH)+Q(I)
835 NEXTI
837 FORI=4TO19:BD(I,4)=Q(I)*Z:NEXTI
840 IFBD(4,4)>BD(4,2)THENQ(4)=BD(4,2)/Z
850 IFBD(5,4)>BD(5,2)THENQ(5)=BD(5,2)/Z
860 IFBD(5,4)<BD(5,3)THENQ(5)=BD(5,3)/Z
870 IFBD(6,4)>BD(6,2)THENQ(6)=BD(6,2)/Z
880 IFBD(6,4)<BD(6,3)THENQ(6)=BD(6,3)/Z
890 IFBD(7,4)>BD(7,2)THENQ(7)=BD(7,2)/Z
900 IFBD(7,4)<BD(7,3)THENQ(7)=BD(7,3)/Z
910 IFBD(8,4)>BD(8,2)THENQ(8)=BD(8,2)/Z
920 IFBD(9,4)>BD(9,2)THENQ(9)=BD(9,2)/Z
930 IFBD(9,4)<BD(9,3)THENQ(9)=BD(9,3)/Z
940 IFBD(10,4)>BD(10,2)THENQ(10)=BD(10,2)/Z
950 IFBD(11,4)>BD(11,2)THENQ(11)=BD(11,2)/Z
960 IFBD(11,4)<BD(11,3)THENQ(11)=BD(11,3)/Z
970 IFBD(12,4)>BD(12,2)THENQ(12)=BD(12,2)/Z
980 IFBD(13,4)>BD(13,2)THENQ(13)=BD(13,2)/Z
990 IFBD(14,4)>BD(14,2)THENQ(14)=BD(14,2)/Z
1000 IFBD(15,4)>BD(15,2)THENQ(15)=BD(15,2)/Z
1010 IFBD(16,4)>BD(16,2)THENQ(16)=BD(16,2)/Z
1020 IFBD(16,4)<BD(16,3)THENQ(16)=BD(16,3)/Z
1030 IFBD(17,4)>BD(17,2)THENQ(17)=BD(17,2)/Z
1040 IFBD(17,4)<BD(17,3)THENQ(17)=BD(17,3)/Z
1042 IFBD(18,4)>BD(18,1)THENQ(18)=(.8*BD(18,1))/Z
1045 TT=0:DN=0
1050 FORI=10TO17:BD(I,4)=Q(I)*Z:IFBD(I,4)<5THENQ(I)=5/Z
1060 NEXTI:FORI=1TO19:TT=TT+Q(I):NEXTI
1070 FORI=4TO19:DN=DN+Q(I):NEXTI:KO=KO+1:IFKO=10THENGOTO1110
1080 IFTT>=1THENGOTO1110
1085 SH=1-TT
1090 FORI=4TO19:IFQ(I)=0THENGOTO1105
1100 Q(I)=Q(I)+((Q(I)/DN)*SH)
1105 NEXTI
1107 GOTO837
1110 IFTT<1Q(19)=Q(19)+1-TT
1120 IFTT>1Q(8)=Q(8)-TT+1
1125 BD(20,1)=0:BD(20,4)=0:BD(20,5)=0:BD(20,6)=0
1130 IFQ(8)>0THENGOTO1160
1140 CR=Q(8):Q(8)=0:Q(15)=Q(15)+CR:IFQ(15)>0THENGOTO1160
1150 CR=Q(15):Q(15)=0:Q(19)=Q(19)+CR
1160 FORI=1TO19:BD(20,1)=BD(20,1)+BD(I,1):BD(I,4)=Q(I)*Z
1170 BD(20,4)=BD(20,4)+BD(I,4):NEXTI:DN=Z:IFBD(20,1)>ZTHENDN=BD(20,1)
1180 FORI=1TO19:IFBD(I,1)=0THENBD(I,5)=0:GOTO1200
1190 BD(I,5)=(BD(I,1)/DN)*100
1200 IFBD(I,4)>0THENBD(I,6)=(BD(I,4)/DN)*100ELSEBD(I,6)=0
1210 BD(20,5)=BD(20,5)+BD(I,5)
1220 BD(20,6)=BD(20,6)+BD(I,6)
1225 NEXTI
1230 SR=X(5)+X(6)+X(7)+X(8)+X(9)+X(10)
1235 H1$="#,#####.##"
1240 CLS:PRINT"YOU SAY YOU HAVE $";:PRINTUSINGH1$;Z;:PRINT" PER MONTH TO USE"
1245 LPRINTNA$;", YOU SAY YOU HAVE $";:LPRINTUSINGH1$;Z:LPRINT" PER MONTH TO USE."
1250 PRINT"YOU ARE USING $";SR;" FOR THE FOLLOWING:"
1255 LPRINT"YOU ARE USING $";:LPRINTUSINGH1$;SR;:LPRINT" FOR THE FOLLOWING:"
1285 LPRINT" "
1290 PRINT"FOOD                $";:PRINTUSINGH1$;X(5)
1295 LPRINT"FOOD                $";:LPRINTUSINGH1$;X(5)
1300 PRINT"CAR PAYMENTS        $";:PRINTUSINGH1$;X(6)
1305 LPRINT"CAR PAYMENTS        $";:LPRINTUSINGH1$;X(6)
1310 PRINT"RENT(MORTGAGE)      $";:PRINTUSINGH1$;X(7)
1315 LPRINT"RENT(MORTGAGE)      $";:LPRINTUSINGH1$;X(7)
1320 PRINT"UTILITIES           $";:PRINTUSINGH1$;X(8)
1325 LPRINT"UTILITIES           $";:LPRINTUSINGH1$;X(8)
1330 PRINT"OTHER DEBT PAYMENTS $";:PRINTUSINGH1$;X(9)
1335 LPRINT"OTHER DEBT PAYMENTS $";:LPRINTUSINGH1$;X(9)
1340 PRINT"CHILDCARE, OTHER    $";:PRINTUSINGH1$;X(10)
1345 LPRINT"CHILDCARE, OTHER    $";:LPRINTUSINGH1$;X(10)
1350 IFRS>0GOTO1380
1360 PRINT:PRINT:PRINT:PRINT" OOPS YOU HAVE OVERSPENT BY $";:PRINTUSINGH1$;ABS(RS);:PRINT" PLEASE REVISE"
1365 FORI=1TO4000:NEXTI
1370 GOTO0180
1380 PRINT"SO FAR SO GOOD, THERE IS $";:PRINTUSINGH1$;RS;:PRINT" LEFT TO SPEND":PRINT:PRINT
1382 LPRINT"SO FAR SO GOOD, THERE IS $";:LPRINTUSINGH1$;RS;:LPRINT" LEFT TO SPEND":LPRINT" "
1385 FORI=1TO5000:NEXTI
1390 CLS:PRINT"WE HAVE JUGGLED YOUR MONTHLY BUDGET"
1395 LPRINT"WE HAVE JUGGLED YOUR MONTHLY BUDGET."
1396 LPRINT"HERE ARE OUR GUESSES AND COMPARISONS.":LPRINT" "
1400 PRINT"HERE ARE OUR GUESSES AND COMPARISONS"
1405 FORI=1TO2000:NEXTI
1407 LPRINTTAB(14)"*";:LPRINTTAB(28)"*";:LPRINTTAB(42)"*"
1410 CLS:PRINTTAB(10)" COMPARATIVE MONTHLY BUDGET ANALYSIS"
1415 LPRINTTAB(10)" COMPARATIVE MONTHLY BUDGET ANALYSIS"
1420 H2$="------------------------------------------------------------"
1430 PRINT;H2$
1435 LPRINTH2$
1440 PRINTTAB(27)"YOUR BUDGET  COMPARATIVE BUDGET"
1445 LPRINTTAB(27)"YOUR BUDGET  COMPARATIVE BUDGET"
1450 PRINT"        ITEM            DOLLARS PERCENT   DOLLARS PERCENT"
1455 LPRINT"        ITEM            DOLLARS PERCENT   DOLLARS PERCENT"
1460 PRINT;H2$:PRINT
1465 LPRINTH2$:LPRINT
1470 H3$="$,########.##":H4$="####.##":PRINT" TAKE HOME PAY      ";:PRINTUSINGH3$;DN;:PRINT"      ";:PRINTUSINGH3$;Z
1475 LPRINT" TAKE HOME PAY      ";:LPRINTUSINGH3$;DN;:LPRINT"      ";:LPRINTUSINGH3$;Z
1480 PRINT:PRINT:LPRINT" "
1485 PRINT"  EXPENSES":LPRINT"  EXPENSES"
1486 FORI=1TO10:PRINTT$(I);:PRINTUSINGH3$;BD(I,1);:PRINTUSINGH4$;BD(I,5);:PRINTUSINGH3$;BD(I,4);:PRINTUSINGH4$;BD(I,6):NEXTI:FORI=1T
05000:NEXTI
1489 CLS
1490 FORI=11TO20:PRINTT$(I);:PRINTUSINGH3$;BD(I,1);:PRINTUSINGH4$;BD(I,5);:PRINTUSINGH3$;BD(I,4);:PRINTUSINGH4$;BD(I,6):NEXTI
1495 FORI=1TO20:LPRINTT$(I);:LPRINTUSINGH3$;BD(I,1);:LPRINTUSINGH4$;BD(I,5);:LPRINTUSINGH3$;BD(I,4);:LPRINTUSINGH4$;BD(I,6):NEXTI
1498 LPRINT" ":LPRINT" ":LPRINT" "
1500 CLS:PRINT"MONEY CAN BUY MORE IF YOU PLAN":PRINT:PRINT"  COMMENTS"
1505 LPRINT"MONEY CAN BUY MORE IF YOU PLAN":LPRINT" ":LPRINT"  COMMENTS"
1510 F1=0:F2=0:FORI=1TO8:F1=F1+BD(I,5):F2=F2+BD(I,1):NEXTI
1520 F3=100-F1:F4=Z-F2:PRINT"AN ESTIMATED ";:PRINTUSINGH4$;F1;:PRINT"% OR $";:PRINTUSINGH4$;F2;:PRINT" OF YOUR BUDGET"
1525 LPRINT"AN ESTIMATED ";:LPRINTUSINGH4$;F1;:LPRINT"% OR $";:LPRINTUSINGH4$;F2;:LPRINT" OF YOUR BUDGET"
1530 PRINT"GOES FOR FOOD, HOUSING, AUTO & OTHER DEBT."
1535 LPRINT"GOES FOR FOOD, HOUSING, AUTO & OTHER DEBT."
1540 IFF3>0PRINT"THIS LEAVES ";:PRINTUSINGH4$;F3;:PRINT"% OR $";:PRINTUSINGH4$;F4;:PRINT" TO DECIDE ABOUT.":LPRINT"THIS LEAVES ";:LP
RINTUSINGH4$;F3;:LPRINT"% OR $";:LPRINTUSINGH4$;F4;:LPRINT" TO DECIDE ABOUT."
1550 IF F1>70ORF4<200PRINT"YOU NEED CAREFUL PLANNING TO GET BY ON YOUR BUDGET.":LPRINT"YOU NEED CAREFUL PLANNING TO GET BY ON YOUR B
UDGET."
1560 IFF1<55PRINT" CONGRATULATIONS--YOU ARE BETTER OFF THAN MOST.":LPRINT" CONGRATULATIONS--YOU ARE BETTER OFF THAN MOST."
1570 SX=ABS(BD(19,1)):IFBD(19,1)<0PRINT"WE GUESS YOU WILL NEED $";:PRINTUSINGH4$;SX;:PRINT" FROM SAVINGS.":LPRINT"WE GUESS YOU WILL
NEED $";:LPRINTUSINGH4$;SX;:LPRINT" FROM SAVINGS."
1580 IFBD(19,1)<0PRINT"OR FROM A LOAN TO GET BY EACH MONTH.":LPRINT"OR FROM A LOAN TO GET BY EACH MONTH."
1590 F1=BD(1,1)-BD(1,4):IFF1>50PRINT"YOU MAY BE ABLE TO REDUCE YOUR FOOD BUDGET.":LPRINT"YOU MAY BE ABLE TO REDUCE YOUR FOOD BUDGET.
"
1600 F1=BD(4,1)-BD(4,4):IFF1>50PRINT"YOU MIGHT CUT CAR COST.":LPRINT"YOU MIGHT CUT CAR COST."
1610 F1=BD(8,5)-BD(8,6):IFF1>10PRINT"YOUR OTHER DEBT NEEDS TO BE REDUCED.":LPRINT"YOUR OTHER DEBT NEEDS TO BE REDUCED."
1620 PRINT:PRINT:PRINT"STAY WITH IT ";NA$
1625 LPRINT" ":LPRINT" ":LPRINT"STAY WITH IT ";NA$:FORX=1TO8:LPRINT" ":NEXTX
1630 KK=KK+1:INPUT"DO YOU WISH TO REVISE YOUR BUDGET  (Y OR N)";AN$
1635 IFAN$="N"ORAN$="NO"GOTO1830
1636 CLS:PRINT"YOUR MONTHLY INCOME FIGURE IS $";Z
1637 INPUT"EITHER REENTER THAT FIGURE OR A NEW ONE";Z
1640 CLS:PRINT"YOUR MONTHLY FOOD  FIGURE IS $";BD(1,1)
1650 INPUT"EITHER REENTER THAT FIGURE OR A NEW ONE";X(5)
1660 CLS:PRINT"YOUR CAR PAYMENTS FIGURE IS $";BD(4,1)
1670 INPUT"REENTER THAT FIGURE OR A NEW ONE";X(6)
1680 CLS:PRINT"YOUR RENT(MORTGAGE) INCLUDING TAX & INSURANCE IS $";BD(2,1)
1690 INPUT"REENTER THAT FIGURE OR A NEW ONE";X(7)
1700 CLS:PRINT"YOUR UTILITIES ESTIMATE IS $";BD(3,1)
1710 INPUT"REENTER THAT FIGURE OR A NEW ONE";X(8)
1720 CLS:PRINT"YOUR OTHER DEBT FIGURE IS $";BD(8,1)
1730 INPUT"REENTER THAT FIGURE OR A NEW ONE";X(9)
1740 CLS:PRINT"YOUR CHILDCARE, ALIMONY, HOUSEHOLD HELP & OTHER FIGURE IS $";BD(18,1)
1750 INPUT"REENTER THAT FIGURE OR A NEW ONE";X(10)
1755 H9$="                              MOST        LEAST"
1760 N=5:NN=7:K1=0
1770 FORI=NTONN
1775 CLS:PRINT"BELOW ARE THE LARGEST AND SMALLEST AMOUNTS ALLOWED PER MONTH":K1=K1+1:PRINT:PRINT
1780 PRINTH9$:PRINTT$(I);:PRINTUSINGH3$;BD(I,2);BD(I,3)
1800 INPUT"REENTER THE LARGEST AND SMALLEST FIGURES YOU WANT USED";BD(I,2),BD(I,3)
1810 INPUT"ARE FIGURES OK (Y OR N)";AN$:IFAN$="N"ORAN$="NO"THEN GOTO1800
1820 NEXTI
1825 N=9:NN=17:IFK1=3THENGOTO1770ELSEGOTO1826
1826 CLS:PRINT@520,"BE PATIENT--I'M WORKING AGAIN":GOTO270
1830 END
```

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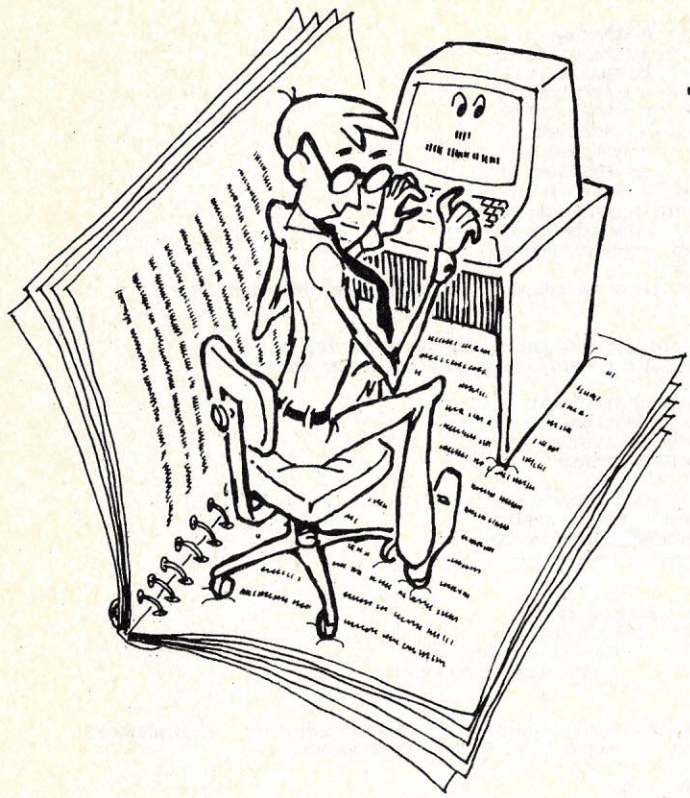

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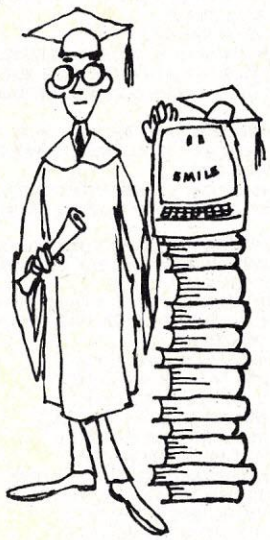

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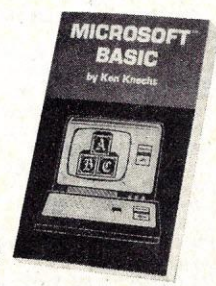

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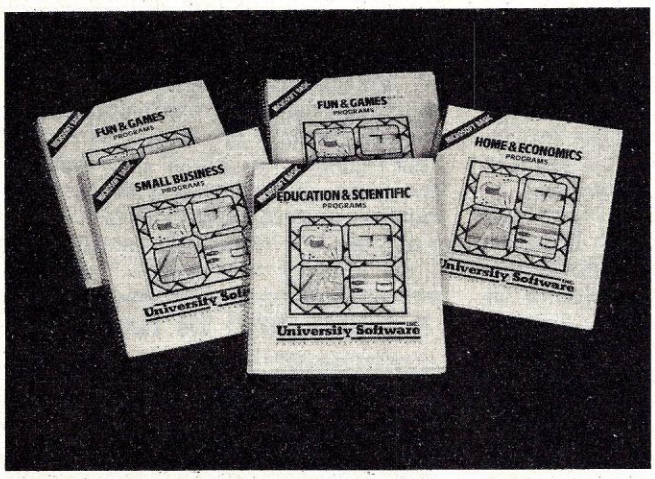

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Shoplist: The Latest Kitchen Utensil

James McClure

Have you ever gone to the supermarket for a special item, only to return home without it? Or, have you ever made several trips because of things you neglected to get? If you, or perhaps your partner, are having trouble coordinating your shopping trips, the following article may be for you.

In an era when personal computers have finally become affordable, it makes good sense to have one in the kitchen. Various articles have been written about computer recipe filers and menu planners; however, another good use for a kitchen computer is in modernizing the food shopping list. After all, computers are natural data handlers, and a shopping list is really only a group of data items.

In an era when personal computers have finally become affordable, it makes good sense to have one in the kitchen.

In this article, I will detail a program which I have written to computerize the family shopping list. The program, called Shoplist, was written to run under the CP/M operating system in the popular Microsoft Basic. It requires under 7K memory, handles a master list of 100 different grocery items (this can be expanded if the computer has more than 7K) and provides for easy creation, printing and updating of shopping lists. The program was written for use with a floppy disk. However, since only one sequential access file is required, a cassette recorder would work as well. Any console with scrolling, 16 or more display lines and 80 characters across can be used. Needless to say, the program can be adapted to accomodate terminals with characteristics different from those mentioned.

Before describing its operation, I think it's important to point out that this program is not for everyone. If the family computer is inconveniently located in the attic (with the bats), or if no one in the family eats, or if the family shopper loves to spend extra time, gasoline and money running back and forth to the supermarket, then the Shoplist program is definitely not appropriate. On the other hand, if the home computer is located in or near the kitchen and is easily operated, then Shoplist is definitely worth considering.

James McClure, 1019 Van Kirk St., Philadelphia, PA 19149.

Operation

Detailed instructions regarding Shoplist follow. Because they are detailed, these instructions may appear complicated, however, don't be fooled. The program is really quite simple to operate, as will be seen after you try it a few times.

The operation of Shoplist centers around a master list of grocery items. In the original version, up to 100 items may be entered via the "Enter" command. After pressing the letter "E" and the return key, the computer will prompt for the name of the item to be added to the list. Once this name is entered, it is stored alphabetically in the master list which is then reprinted on the screen. Notice that because the computer stores the items alphabetically, the item names should all begin with either a capital or a small letter, it is not important which, but it is important to be consistent.

All items which are entered into the master list are assigned a number which will appear within square brackets ("[...]") next to the item name whenever the list is printed. For convenience, these numbers will be used in place of the full item name. At no time, however, will the operator be required to remember the number of a given item—it will always be displayed on the screen beside the item's name. The sole purpose of the item code, which will change as items are entered, deleted and modified, is to save the operator from constant typing out of whole names of an item.

When Shoplist is first run, it will be necessary to enter all the groceries that are normally bought by the family. Once this is done (via the "Enter" command) the list does not need be re-entered; it will be stored automatically whenever required.

If any mistakes are made while entering the name of an item, the "Change" function may be invoked by typing the letter "C" followed by a return. After this is done, the computer will ask for the code of the item to be changed. If an illegal code is entered (a number less than one or greater than the number of items in the list) the request will be repeated. Once a proper code has been entered, you will then be asked to type the corrected item name. After this, the computer will reprint the master list, incorporating the edited grocery name.

If you wish to delete an item in the master list, call the "Delete" command by typing a "D" and a return. Next, enter the code of the item to be deleted. This function will cause the specified item to disappear from the master list.

It is quite possible that more items will be entered than can be displayed simultaneously on the screen. For this reason, the "Page" command is available. A page constitutes the number of item names printed at one time on the terminal, normally 12 lines * 3 items = 36 names. If an item is not visible on the display, simply press "P" followed by a return, followed by an "N" to move forward a page, this will cause the next group of 36 items to be displayed. In place of "N", an absolute page number may also be entered. For instance, to return to the beginning of the master list, enter "1" for the page number; to move to the end of the list, type a large number, such as "99." Any intermediate value is also acceptable and will cause the computer to display the corresponding group of 36 items.

A short form of the "List" command is available for those instances where a quick list is wanted.

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CIRCLE 221 ON READER SERVICE CARD

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Shoplist, cont'd...

```
                    MAJOR ROUTINES

 1000 - 1090  INITIALIZATION ROUTINE: THE ARRAYS ARE CREATED, THE
                DATA FILE IS READ, AND THE CONSTANTS ARE ASSIGNED.
 2000 - 2095  MENU PRINT ROUTINE: THE LIST OF OPTIONS IS PRINTED, AND
                A GOSUB IS PERFORMED TO THE DESIRED FUNCTION BLOCK.


                  FUNCTION SUBROUTINES

         3000 - 3035  "ENTER" FUNCTION
         4000 - 4030  "SELECT" FUNCTION
         5000 - 5040  "PAGE" FUNCTION
         6000 - 6105  "LIST" FUNCTION (LONG FORM)
         7000 - 7045  "CHANGE" FUNCTION
         7500 - 7595  "RESET" FUNCTION
         8000 - 8045  "DELETE" FUNCTION
         9000 - 9275  "LIST" FUNCTION (SHORT FORM)
        10300 -10310  "QUIT" FUNCTION


                  SUPPORT SUBROUTINES

 10000 - 10040  PRINTS MASTER LIST ON CONSOLE.
 10100 - 10135  UPDATES DATA FILE.
 10200 - 10235  GETS AND TESTS ANSWER FOR YES/NO QUESTION.
```

Table 1. Program Breakdown.

```
                    Shopping List

[  1]  4 BREAD              [  3]  1 JAM              [  5]  2 SODA
[  9]  3 MILK               [ 10]  1 PASTRIES         [ 12]  2 TEA BAGS
[ 15]  6 ORANGE JUICE       [ 17]  2 STEAK SAUCE      [ 18]  3 TOILET PAPER
```

Figure 1. A sample shopping list (printed using the List command).

```
                    Quick List

 2 SODA                 2 MILK                 2 BREAD
 2 LUTTUCE              1 CUCUMBERS
```

Figure 2. The short form list for those unexpected trips to convenience stores. Note that these items can be deleted from the master (full) list which will be used on shopping day.

```
A>ED SHOPLIST.DAT

NEW FILE
*I                              TYPE SHOPLIST.DAT
BREAD,                          "BREAD", 0
CHEESE,                         "CHEESE", 0
JAM,                            "JAM", 0
PAPER TOWELS,                   "PAPER TOWELS", 0
SODA,                           "SODA", 0
TAFFIES,                        "TAFFIES", 0
CANNED FRUIT,                   "CANNED FRUIT", 0
FROZEN VEG,                     "FROZEN VEG", 0
MILK,                           "MILK", 0
PASTRIES,                       "PASTRIES", 0
STEAK,                          "STEAK", 0
TEA BAGS,                       "TEA BAGS", 0
CATSUP,                         "CATSUP", 0
ICED TEA,                       "ICED TEA", 0
IUICE,                          "ORANGE JUICE", 0
SALT,                           "SALT", 0
STEAK SAUCE,                    "STEAK SAUCE", 0
TOILET PAPER                    "TOILET PAPER ", 0

*E                              A>
```

Figure 3. The creation of the initial data file (all grocery items usually bought) is an important step and must be done before the program is RUN. The file is created and the data entered using the system editor as shown in 3a. (Important Note: Be sure to leave off comma at end of last data item). Figure 3b shows how the file looks after being accessed by Microsoft BASIC (the zeros will be updated by the program to reflect the quantity wanted for that particular item).

As you begin to run out of groceries, use the "Select" command to mark them as needed. Simply press "S" and a return, followed by the code of the item which needs to be purchased. The computer will then ask for the quantity desired. To answer this, type the number of cans (or boxes, bags, etc.) which are needed. Whenever the grocery list is printed, the quantity needed will appear immediately in front of each item's name.

After the select command is used, the master list will not be reprinted.

The data file holding the master grocery list is sequential and is read once when the program is loaded, and written once when it is exited.

This is done for convenience, so the command can be invoked several times in quick succession without waiting for the master list to be printed each time. If, however, the list scrolls off the screen, the "View" command will bring it back so the user is never left in the dark.

When the time comes for a major shopping trip, use the "List" command. The computer will ask whether a full or short list is desired - enter an "F" for a full list. After this prompt, the computer will ask whether the printer is on and ready. At this time, make sure there is paper in the printer and it is switched on. Afterwards, type a "Y". (Typing a "N" is also valid; it causes the list to be printed on the console instead of the printer.) The computer will then print, in alphabetical order, a list of all the required grocery items, preceded by the quantities needed of each. (See Figure 1 for a sample shopping list.)

Once the shopping is finished, the "Reset" command may be invoked to reset the quantities of the items that were brought back to zero. After you have typed an "R" followed by a return, the computer will ask if all items are to be reset. If you didn't find all the items on your list, "N" is the response. However, if all the needed items were found and purchased, typing a "Y" will reset all the grocery items.

Assuming an "N" has been typed, the computer will then list the items that were to be purchased. If the given item was bought, simply type a return and the computer will mark that item as not needed, and proceed to the

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CIRCLE 194 ON READER SERVICE CARD

Shoplist, cont'd...

next item. However, if the item was not available, or if not enough of it was bought, enter the quantity which remains to be purchased followed by a return. After storing this information, the computer will then proceed to the next item.

At some time it may be desirable to make a quick trip to a nearby convenience store. Sometimes a list may not be necessary; nonetheless, a short form of the "List" command is available for those instances where a quick list is wanted. After invoking the "List" command, type an "S" to select the short form. At this time, the computer will ask whether any items are desired from the master list. If you answer "Y", the computer will ask for the codes and quantities of the items needed; otherwise, the next prompt will ask whether you wish to type in the names of any special groceries not appearing on the master list. If you choose to do so, you may then type the names and the quantities needed of these special items. Once this is finished, the computer will then print out the entire list. (See Figure 2 for a sample of the short form list).

When you are finished with Shoplist and wish to terminate the program, invoke the "Quit" command by typing a "Q" followed by a return. If any changes have been made to the master list requiring it to be rewritten on the mass storage device, there will be a delay while the data is output, after which the computer will stop. If

A home computer, once purchased, can perform a variety of useful, time saving functions.

the list does not need to be rewritten, the program will terminate immediately and return control to the operating system.

The Program

I have acquired a habit of dividing programs into their functional blocks and the Shoplist program was written in this fashion. There are nine major subroutines, corresponding to the nine functions, which are called from the menu routine at lines 2000 through 2100. These major subroutines, in turn, call various support routines. A list of all the routines, along with a description of each, may be found in Table 1.

As I mentioned earlier, the program was written in Microsoft Disk Extended Basic for CP/M. However,

```
900  REM +++++++++++++++++++++++++++++++++
905  REM +        SHOPLIST               +
910  REM +                               +
920  REM +           by                  +
930  REM +       JIM McCLURE             +
940  REM +                               +
950  REM +           for                 +
960  REM +     CREATIVE COMPUTING        +
970  REM +       April 22, 1979          +
980  REM +++++++++++++++++++++++++++++++++
1000 REM
1005 CLEAR 10000 : WIDTH 80 : DEFINT A-Z
1010 DIM MLIS$(100),MLIS(100),TLIS$(20),TLIS(20)
1015 F1$="[###] ## \                \  "
1020 FA1$="  [###] ## \                \"
1025 F2$="[###]    \              \  "
1030 F3$="  ## \             \"
1035 REM Read list from disk
1040 OPEN "I",1,"SHOPLIST.DAT"
1045 N=1
1050 INPUT # 1,MLIS$(N),MLIS(N)
1055 N=N+1
1060 IF NOT EOF(1) THEN 1050
1065 I=N
1070 CLOSE 1
1075 START=1 : REM Assign 1 as page to be printed
1080 COUNT=3*12 : REM Number of lines of items printed (12 here)
1085 U=0 : REM Signals whether file must be rewritten
1090 US=1 : REM Screen Update initially required
2000 REM Menu print
2005 IF US=0 THEN 2035
2010 PRINT "Master List: ";I-1;" Items";
2015 PRINT "          Format: [<code>] <qty> <item name>"
2020 PRINT
2025 GOSUB 10000
2030 PRINT
2035 PRINT "Shoplist: C(hange D(elete E(nter L(ist P(age";
2040 PRINT " R(eset S(elect V(iew Q(uit";
2045 INPUT OPT$ : OPT$=LEFT$(OPT$,1)
2050 IF (OPT$>="a") AND (OPT$<="z") THEN OPT$=CHR$(ASC(OPT$)-32)
2055 US=1 : IF OPT$="V" THEN 2000
2060 IF OPT$="C" THEN GOSUB 7000
2065 IF OPT$="D" THEN GOSUB 8000
2070 IF OPT$="E" THEN GOSUB 3000
2075 IF OPT$="L" THEN GOSUB 6000
2080 IF OPT$="P" THEN GOSUB 5000
2085 IF OPT$="S" THEN GOSUB 4000
2090 IF OPT$="Q" THEN GOSUB 10300
2095 IF OPT$="R" THEN GOSUB 7500
2100 GOTO 2000
3000 REM Enter
3005 INPUT "Name of item to add to list";N$
3010 FOR N=1 TO I-1
3015    IF N$>MLIS$(N) THEN NEXT N
3020 FOR N1=I TO N+1 STEP -1
3025    MLIS$(N1)=MLIS$(N1-1)
3030    MLIS(N1)=MLIS(N1-1)
3035 NEXT N1
3040 MLIS$(N)=N$ : MLIS(N)=0
3045 I=I+1
3050 U=1
3055 RETURN
4000 REM Choose
4005 INPUT "Code number of item to be bought";C
4010 IF C>=I OR C<1 THEN 4005
4015 PRINT "What quantity of ";MLIS$(C);
4020 INPUT MLIS(C)
4025 U=1 : US=0
4030 RETURN
5000 REM Page command
5005 INPUT "What page number (enter n for next)";PAGEN$
5010 IF PAGEN$="n" OR PAGEN$="N" THEN 5020
5015 START=(VAL(PAGEN$)-1)*COUNT+1 : GOTO 5025
5020 START=START+COUNT
5025 IF I-COUNT<1 THEN RETURN
5030 IF START<1 THEN START=1
5035 IF START>I-COUNT THEN START=I-COUNT
5040 RETURN
6000 REM Print list to printer
6005 INPUT "Do you want the full list or a short one (F or S)";L$
6010 L$=LEFT$(L$,1)
6015 IF L$="S" OR L$="s" THEN 9000
6020 IF NOT (L$="F" OR L$="f") THEN 6005
6025 PRINT "Is the printer switched on";
6030 GOSUB 10200
6035 P=ANSWER
6040 PRINT:IF P THEN LPRINT
```

Shoplist, cont'd...

```
6045 PRINT TAB(32);"Shopping List"
6050 IF P THEN LPRINT TAB(32);"Shopping List"
6055 PRINT:IF P THEN LPRINT
6060 FOR N=1 TO I-1
6065    IF MLIS(N)=0 THEN 6085
6070    PRINT USING FA1$;N,MLIS(N),MLIS$(N);
6075    IF P THEN LPRINT USING FA1$;N,MLIS(N),MLIS$(N);
6080    IF POS(0)=78 THEN PRINT:IF P THEN LPRINT
6085 NEXT N
6090 IF POS(0)>1 THEN PRINT:IF P THEN LPRINT
6095 PRINT:IF P THEN LPRINT
6100 IF NOT P THEN INPUT "Are you finished reading";ANSWER$
6105 RETURN
7000 REM Change command
7005 INPUT "Code number of item to change";C
7010 IF C>=I OR C<1 THEN 7005
7015 PRINT "Change ";MLIS$(C);" to what";
7020 INPUT N$
7025 Q=MLIS(C)
7030 GOSUB 8015 : REM Delete previous entry
7035 GOSUB 3010 : REM Enter new entry
7040 MLIS(N)=Q
7045 RETURN
7500 REM Reset command
7505 PRINT "Are all items to be reset";
7510 GOSUB 10200
7515 IF NOT ANSWER THEN 7545
7520 FOR N=1 TO I-1
7525    MLIS(N)=0
7530 NEXT N
7535 U=1
7540 RETURN
7545 PRINT
7550 PRINT "Here is a list of the items you were to buy."
7552 PRINT "For each item, enter a return if it was purchased,"
7555 PRINT "or, if not, the quantity remaining to be bought."
7560 PRINT
7565 FOR N=1 TO I-1
7570    IF MLIS(N)=0 THEN 7590
7575    PRINT MLIS(N);"  ";MLIS$(N);
7580    MLIS(N)=0
7585    INPUT MLIS(N)
7590 NEXT N
7595 RETURN
8000 REM Delete
8005 INPUT "Code number of item to delete";C
8010 IF C>=I OR C<1 THEN 8005
8015 FOR N=C+1 TO I-1
8020    MLIS$(N-1)=MLIS$(N)
8025    MLIS(N-1)=MLIS(N)
8030 NEXT N
8035 I=I-1
8040 U=1
8045 RETURN
9000 REM Temporary List
9005 TI=1
9010 COUNT=COUNT-4*3 : REM Decrease count by 4 lines
9015 PRINT "Do you want any items from the master list";
9020 GOSUB 10200
9025 IF ANSWER THEN GOSUB 9140
9030 PRINT "Do you wish to type in any special items";
9035 GOSUB 10200
9040 IF ANSWER THEN GOSUB 9235
9045 PRINT "Is the printer switched on";
9050 GOSUB 10200
9055 P=ANSWER
9060 PRINT:IF P THEN LPRINT
9065 PRINT TAB(24);"Quick List"
9070 IF P THEN LPRINT TAB(24);"Quick List"
9075 PRINT:IF P THEN LPRINT
9080 FOR N=1 TO TI-1
9085    PRINT USING F3$;TLIS(N),TLIS$(N);
9090    IF P THEN LPRINT USING F3$;TLIS(N),TLIS$(N);
9095    IF POS(0)=60 THEN PRINT:IF P THEN LPRINT
9100 NEXT N
9105 IF POS(0)>1 THEN PRINT:IF P THEN LPRINT
9110 PRINT:IF P THEN LPRINT
9115 IF NOT P THEN INPUT "Are you finished reading";ANSWER$
9120 COUNT=COUNT+4*3 : REM Restore count
9125 PAGE$="1"
9130 GOSUB 5010
9135 RETURN
9140 REM CLEAR SCREEN
9145 GOSUB 10000
9150 PRINT
9155 PRINT "Enter a zero to stop or an 'n' to advance page"
9160 PRINT USING "Code number of item ##";TI;
```

Shoplist does not use any commands which cannot be found in most 8K Basics, and even in some smaller Basic interpreters. Only three groups of instructions peculiar to extended Basics were used in the program and these may be changed.

First, the disk commands OPEN, CLOSE, INPUT and PRINT, as well as the EOF function were utilized. As stated before, the data file holding the master grocery list is sequential and is read once when the program is loaded, and written once when it is exited. (It is, of course, important that the initial list be created, using the system editor, prior to running th program. (See Figure 3.) Thus, cassette commands may be easily substituted for the disk statements. In fact, since some Basics are able to load and save arrays with one command, programming the mass storage I/O may even be easier in other language implementations.

The second extended command used by Shoplist is the PRINT USING statement. The use of this command greatly simplified portions of the program and was therefore included for the sake of clarity and brevity. Furthermore, most newer Basics have some form of formatted PRINT and it will undoubtedly be easier to translate from a PRINT USING command into a simpler format than vice versa. Nonetheless, if no print formatting is available, the USING statements may be omitted and the print spacing effected by other means.

The final extended command used by the shopping list program is the LPRINT statement. For the program to be at all useful, it must be able to provide a hard copy of the shopping list, and in Microsoft's Basic, LPRINT is the only means of doing this. Most other good Basics have some command which will direct output to a line printer instead of the console; simply change the LPRINT statements in the program to whatever will achieve the same result. If there are any other extended commands in Shoplist, they may be left out without adversely affecting the program.

The program, as shown in the listing, reserves room for 100 grocery items. This may be changed to any number (as long as there is enough memory) by changing the dimensions of MLIS$ and MLIS on line 1010 and adjusting the CLEAR statement on line 1005 to allow for the extra items (if necessary). The number of items printed per page of display can also be changed by adjusting the value

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CIRCLE 165 ON READER SERVICE CARD

Shoplist, cont'd...

```
9165 INPUT PAGEN$
9170 IF PAGEN$="n" OR PAGEN$="N" THEN GOSUB 5010:GOTO 9140
9175 C=VAL(PAGEN$)
9180 IF C=0 THEN RETURN
9185 IF C>=I OR C<1 THEN 9160
9190 TLIS$(TI)=MLIS$(C)
9195 PRINT "What quantity of ";TLIS$(TI);
9200 INPUT TLIS(TI)
9205 PRINT "Subtract from master list";
9210 GOSUB 10200
9215 IF ANSWER THEN MLIS(C)=MLIS(C)-TLIS(TI)
9220 IF MLIS(C)<0 THEN MLIS(C)=0
9225 TI=TI+1
9230 GOTO 9160
9235 PRINT
9240 PRINT "Type a blank line to stop"
9245 PRINT USING "Name of item ##";TI;
9250 INPUT TLIS$(TI)
9255 IF LEN(TLIS$(TI))=0 THEN RETURN
9260 PRINT "What quantity of ";TLIS$(TI);
9265 INPUT TLIS(TI)
9270 TI=TI+1
9275 GOTO 9245
10000 REM Print list
10005 FOR N=START TO START+COUNT-1
10010   IF MLIS(N)=0 THEN 10020
10015   PRINT USING F1$;N,MLIS(N),MLIS$(N); : GOTO 10025
10020   PRINT USING F2$;N,MLIS$(N);
10025   IF POS(0)=78 THEN PRINT
10030   IF N<I-1 THEN NEXT N
10035 IF POS(0)>1 THEN PRINT
10040 RETURN
10100 REM Update data file
10105 KILL "SHOPLIST.DAT"
10110 OPEN "O",1,"SHOPLIST.DAT"
10115 FOR N=1 TO I-1
10120   PRINT #1,CHR$(34);MLIS$(N);CHR$(34);",";MLIS(N)
10125 NEXT N
10130 CLOSE 1
10135 RETURN
10200 REM Yes/No Answer
10205 ANSWER=1
10210 INPUT ANSWER$
10215 IF LEFT$(ANSWER$,1)="Y" OR LEFT$(ANSWER$,1)="y" THEN ANSWER=-1
10220 IF LEFT$(ANSWER$,1)="N" OR LEFT$(ANSWER$,1)="n" THEN ANSWER=0
10225 IF ANSWER<1 THEN RETURN
10230 PRINT "Please answer either yes or no";
10235 GOTO 10210
10300 REM Quit
10305 IF U=1 THEN GOSUB 10100
10308 SYSTEM
10310 END
```

given to COUNT on line 1080. COUNT should be assigned as follows:

COUNT = (# of items/line) * (# of lines on terminal - 4)

The number of items per line is governed by the fact that each item takes 26 characters of space on the display. Thus, an 80 column terminal can print up to 3*26 or 78 characters before a carriage return is necessary. This is the reason that the cursor position is tested on line 10025 to see if it equals 78. For a 64 character terminal, the "78" should be changed to 2*26 or "52;" this will cause only two items to be printed per line.

A similar situation is encountered within the quick list subroutine at line 9095. In this case, each item takes only 20 characters of space to display, so 3*20 or 60 characters can be printed before a carriage return is needed. This value will work for either 64 or 80 column terminals, but will have to be changed for narrower displays.

Conclusion

A home computer, once purchased, can perform a variety of useful, time saving functions. For some families, an automated shopping list may be overkill. However, for those of you who could use a hand with your grocery buying, try Shoplist. It'll make a wonderful addition to any kitchen! □

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Dear Computer:

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— Computer Widow

Dear Widow:

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"Kick-back cash" is waiting

Computing Trash to Treasure

Jacqueline Miller

"That woman just pushed out two carts with $64.19 in free groceries!"

I could hear the words rumble from one cash register aisle to another as my daughter and I pushed laden, goodie-filled carts to our car in the parking lot. The clerks might just as well have screamed "Stop that woman, she's a thief!" the impact was so great as the eyes of nearby shoppers glued themselves on us in disbelief.

But it was true. It is a weekly occurence in our household because I've discovered how to fight inflation by an effective and fun-filled way, and what's more important, you can too.

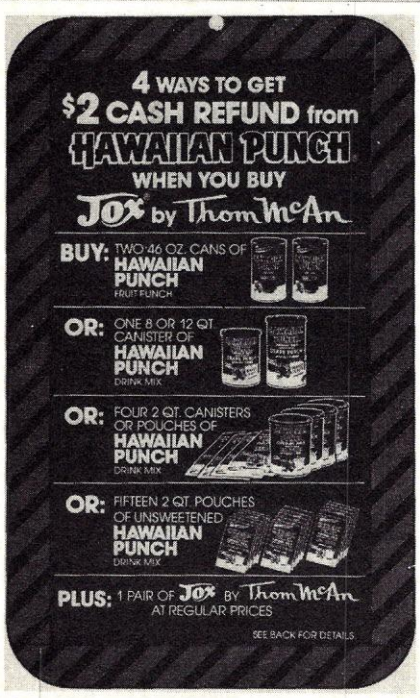
It started with our home computer. My husband had it programmed to pay our bills, make out our Christmas card/gift list, computerize his favorite baseball batting averages, even finalizing to the decimal point our utility bills, gasoline consumption, etc. I secretly felt, when I saw him poking around my recipe file, that he'd know how many calories I was sneaking in the newest dessert. My husband programmed our system to do all those efficient, time-saving, knowledgeable things. The little homemaker taught our computer how to reward us with "kick-back-hard-cash" and here's proof that you can too.

Several years ago I became engrossed in a new hobby called refunding. If you aren't familiar with the newest hobby sweeping the country, and a new economy to housewives and the family purchaser, let me tell you about it. Refunding is money received back for having bought a specific product. In many ways it is advertising for the manufacturer, a proof that the consumer is buying his product, and he's glad to reward the user with cash, coupons or even merchandise.

Jacqueline Miller, 3540 Mozart Ave., Cheviot, OH 45211

"But how do I know what products are offering a rebate?" you ask. There are several ways:

1-You might find forms on your grocer's shelves, usually taped beneath the specific promotional product. They usually read something like this:


4 WAYS TO GET
$2 CASH REFUND from
HAWAIIAN PUNCH
WHEN YOU BUY
Jox by Thom McAn
BUY: TWO 46 OZ. CANS OF HAWAIIAN PUNCH FRUIT PUNCH
OR: ONE 8 OR 12 QT. CANISTER OF HAWAIIAN PUNCH DRINK MIX
OR: FOUR 2 QT. CANISTERS OR POUCHES OF HAWAIIAN PUNCH DRINK MIX
OR: FIFTEEN 2 QT. POUCHES OF UNSWEETENED HAWAIIAN PUNCH DRINK MIX
PLUS: 1 PAIR OF Jox BY Thom McAn AT REGULAR PRICES
SEE BACK FOR DETAILS

The easiest way for me to refund is to save all labels, boxtops, P.O.P (proof of purchase), net weights, tear strips, inner seals, etc., in a convenient sink drawer. By the time they make it to the basement, they are sorted into boxes labeled: soap, beverage, sweets, food, dairy and miscellaneous. My "desk" is a shoebox that conveniently houses the refund forms filed by expiration date.

2-Newspapers and magazines are additional sources for refund blanks.

3-To become a serious refunder you need to learn about more blanks than you are able to find in local stores, newspapers and magazines. That's where a refund bulletin comes in handy. There are dozens of refunding bulletins. Usually a request will get you a sample, and then you can subscribe. Included here are some of the refund publications, many of which list refunds, plus ads of people willing to swap forms and qualifiers.

The list seemed endless with cash-backs. These are just a few of the hundreds of offers circulating every day turning trash into treasure. I've cited these to illustrate the variety of manufacturers products from detergents to delectables, sweets to spice, cars to cat food.

It doesn't take a genius to figure out the variables that would be fed into the computer. (We're using a general purpose data base program, called Selector III, from Micro-Ap.) In common denominator and of importance was:

1. Expiration date
2. Product
3. Address
4. Refund amount
5. Qualifier (boxtop, tear strip, net weight, UPC symbol, proof of purchase, etc.).
6. Refunds per family (if you have additional refund blanks and qualifiers, you might like to remember that son in college, etc.

The most important point is that my computer never lets me miss an expiration date. I always know how many I've submitted and to whom under the category of "one per family" and, if I wish, I can keep tabs on the manufacturer to see if they've paid off.

As a result of my refunding hobby, we are not only eating less

Some Refund Publications

CASH FLASH, Coupon Saving House, P.O. Box 46577, Dept. JM, Ed. Lynda Bettenhausen, Sample $1.50, 6 months $8; year $12.

CASH FROM TRASH, 107 Loch Rd., Dept. JM, Columbia, SC 29210, Ed. Cheryl Peyehouse. Year, $7.50, ads .10 word.

ROAD RUNNER REFUNDER, 5812 W. Elm, Dept. JM, Phoenix, AZ 85031, Ed. Jan Neuberger, sample .85, 3 mo. $2.50; 6 mo. $4.25, year, $8.

THE COUPON CLIPPER, P.O. Box 305, Dept. JM, Beulah, CO 81023, Ed. Cherie Carter, sample copy, $1; 4 mo. $4, 6 mo. $6, year, $8.95.

MONEY TALK, 181 Jackson St., Dept. JM, Edwardsville, PA 18704, Ed. Jean Kwiatkowski, sample copy, $1; 3 mo. $2.75, 6 mo. $5; year $8.50.

THE MONEY MAKER BULLETIN, Box 439 F, Ballwin, MO 63011, Ed. Carol J. Backs. 1 issue $1.00, 6 issues, $5.50, 12 issues $9.00.

CLIP AND SAVE, P.O. Box 6765, Dept. JM, Jacksonville, FL 32205, Ed. Pat Hinson, single issue $1.00, 6 mo. $5.50, year $10. 2 years, $19, ads .10 word.

SHOPPERS BONUS, P.O. Box 109, Dept. J., Marksville, LA 71351, Ed. Donna Caubarreaux, sample $1; 3 issues, $2.75, 6 issues, $5, 12 issues $9.

REALISTIC REFUNDING, 1196 Schuerman, Dept. JM, Essexville, MI 48732, Ed. Judy Rivard, Year $7; 6 months, $4, 3 months, $2.75, sample $1.

CLIPPERS BULLETIN, Box 422, Dept. JM, Argo, IL 60501, Ed. Barbara Michalik, year $7; 6 months $4; 3 months, $2.25; sample .80

INFLATION FIGHTER, Route 2, Box JM, New Oxford, PA 17350, Ed. Dorothy E. Plosay, year $10; sample copy $2.

Sample Current Offers

KELLOGG FRUIT AND CEREAL OFFER, P.O. Box 9471, St. Paul, MN 55194, $1.00 toward purchase of any fresh fruit or Kellogg cereal for 4 POP, June 1980, one per family.

THREE BEAN GREEN GIANT, Box 15-536, LeSueur, MN, buy two and get one free, Aug. 31, 1980, one per family.

SIMONIZ, $1.25 cash refund, P.O. Box 4680, Maple Plain, MN 53348, $1.25 for cash register receipt with code number from bottom of can, Jan. 1, 1981, one per family.

DOLLARS FROM NEW FREEDOM®
Get $1.00 back when you buy 2 packages of NEW FREEDOM Beltless Pads (any size).
Send the PRODUCT CODE SYMBOLS from any 2 packages of NEW FREEDOM Mini Pads or Maxi Pads, (except Trial Size) to receive a $1.00 cash refund. Complete details on back
NEW FREEDOM
MAXI
NEW FREEDOM
MINI
OFFER EXPIRES AUGUST 31, 1979.

expensively, but we are eating better. I find myself trying new foods. Who can resist the temptation when you get them either free or with a handsome rebate?

On the humorous side, it's true that many times I've opened a delabeled can expecting to find catfood and it turned out to be corn. And sometimes we don't always have the vegetable we planned for dinner, because the label was somehow mysteriously removed and someone forgot to label the can in the haste to send off for that desired refund. But I've earned the title of Coupon Clipper at my local supermarket, and it's all legitimate and tax free.

Recently, Betty Crocker gave

10% of the grocery bill (up to $3.50) for several qualifiers with a grocery receipt. I made four people, plus myself, $3.50 richer on just that one refund.

The mail today, an ordinary day, netted me the following refunds:

Aim	$1.00
Cracker Jack	coupon for free box
Cremora	$1.50
Hefty	free coupon
Nine Lives Cat Food	Morris T-Shirt
Hershey	$2.00
Land of Lakes	free pound of butter

Can you see how easy it is to average a savings of $20-$30 a week or $1,000-$1,500 a year? Wouldn't you like to get mail like this every day?

You can do it. Let your computer keep track of those "kick-back" items and bring in money for you. Saving $64.19 on my weekly grocery bill is not that remarkable. Would you believe once the store owed me 18 cents? They figured it twice just to make sure of the figures, and as they scratched their heads in amazement, I left happily with several carts of groceries and 18 cents! □

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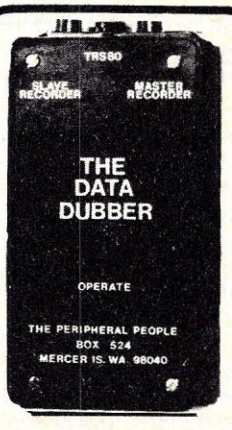
CIRCLE 200 ON READER SERVICE CARD

The "DATA DUBBER"

DUPLICATES ANY PROGRAM TAPE **TRS-80**



Yes, even those in machine language! Feed your cassette into the "Data Dubber" and get out exact replicas of the TRS-80 CSAVE data pulses. Obtain perfect CLOAD's even from tapes with hum, distortion, or minor dropouts. . . and without constantly adjusting the volume. Connect a second cassette to the "Data Dubber" and make perfect reproductions, just as if the data had come from the TRS-80.

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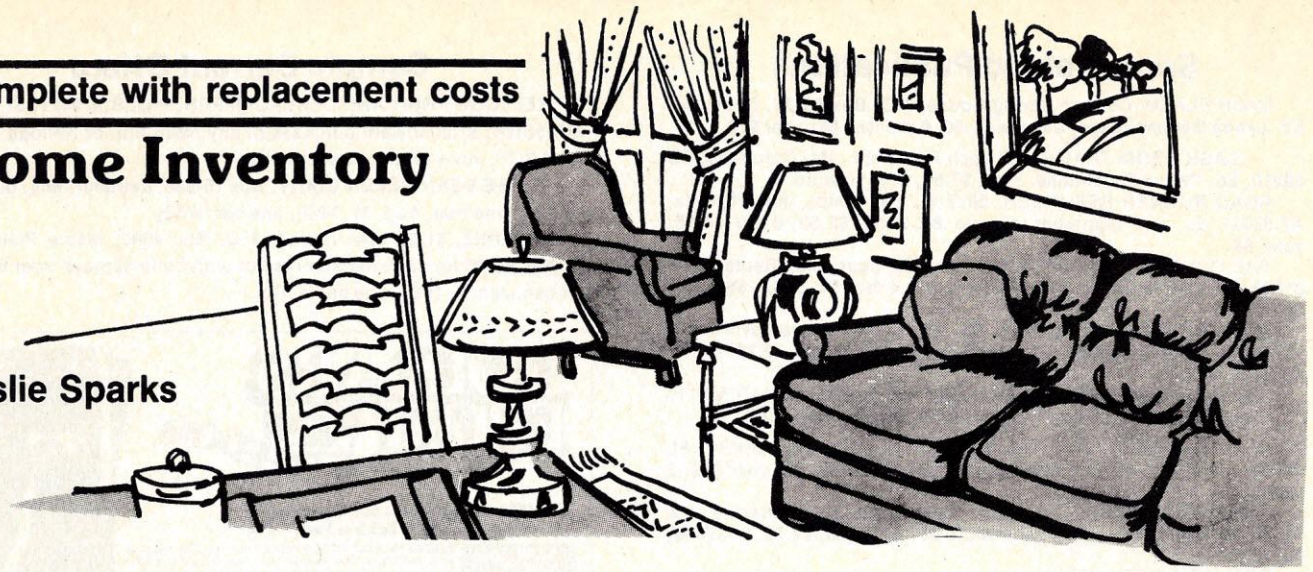
THE PERIPHERAL PEOPLE PO Box 524, Mercer Island, WA 98040

CIRCLE 187 ON READER SERVICE CARD

Complete with replacement costs

Home Inventory



Leslie Sparks

How much would it cost to replace the major items in your home? What are they and where are they? How much have you spent furnishing your home?

How many of the above questions can you answer? If you have a good conventional home inventory you may be able to answer the last two questions. But you still can not answer the first question, which is really the most important one. After all, if something happens, the cost of replacing your belongings becomes very important.

The home inventory program is designed to provide you with all the information that a conventional inventory program will; but the program will also provide you with an estimate of the replacement cost of the items in the inventory. It is this last feature, the estimate of the replacement cost, that makes it worth the effort of programming your computer. If all the program did was allow you to keep a conventional home inventory, it really would not be worth the effort involved in keying in the program.

The cost of any given item may have increased faster than the average or slower.

The program is written in TRS-80 Level II Basic. It is set up for a 16K TRS-80 with cassette storage. A subroutine for hardcopy is provided. Conversion of the program to a disk based system should be a matter of providing file names and changing the PRINT #-1 statements to appropriate disk commands.

The program estimates replacement cost based on the consumer price index published by the U.S. government. (Data for 1945-1978 are provided in the program.) The replacement cost (RC) of an item is given by

$$RC = PC \times CI(\text{now})/CI(\text{when purchased})$$

where PC is the purchase cost, CI(now) is the consumer price index now, and CI(when purchased) is the consumer price index when the item was purchased.

Note that the estimated replacement cost for any given item may be in error. The consumer price index is based on average prices of lots of items. So the cost of any given item may have increased faster than the average or slower (yes, there are such items) than the average. However, the estimated total replacement cost for all items should be accurate.

The inventory is organized on a room by room basis (mainly because I found it easier to conduct the inventory room by room).

The program will prompt you when it needs data input. The following data are asked for:

1. Current consumer price index (about 200)
2. Current year
3. Number of rooms
4. Name of room
5. Name of item
6. Year purchased
7. Purchase price.

```
EXAMPLE OF HARDCOPY

INVENTORY FOR  1979
CURRENT CONSUMER PRICE INDEX IS  200
INVENTORY FOR THE LIVING ROOM
ITEM            PURCHASED       PRICE$          REPLACEMENT$
SOFA             1972            450             718.27
END TABLE        1976            200             234.6
REC. CHAIR       1978            200             205.12
TOTAL PURCHASE PRICE OF ITEMS IN THIS ROOM  850
 TOTAL REPLACEMENT COST OF ITEMS IN THIS ROOM  1157.99
INVENTORY FOR THE DEN ROOM
ITEM            PURCHASED       PRICE$          REPLACEMENT$
DESK             1971            250             412.2
DSK CHAIR        1972            95              151.63
LAMP             1967            50              100
TOTAL PURCHASE PRICE OF ITEMS IN THIS ROOM  395
 TOTAL REPLACEMENT COST OF ITEMS IN THIS ROOM  663.83
TOTAL PURCHASE PRICE OF ALL ITEMS $ 1245
TOTAL REPLACEMENT COST OF ALL ITEMS $ 1821.82
```

Figure 1.
Example of program output. The same information is displayed on the CRT.

The program will ask for data and then print your response on the CRT, and then ask if the information is correct. If not, you will be asked to reenter any incorrect data.

After you have entered all the data, the information shown in Figure 1 will be displayed on the CRT. You will then be asked if you want to save the inventory on tape. (Here's where you have to make minor changes for a disk system.) You are asked to provide a name for the inventory (HOME is the default).

Once you have an inventory on tape, you can add or delete items with the options provided in the program. You can, and should, periodically review the data to see what inflation is doing to you.

Note that when you make changes in an inventory, the whole inventory is read from the tape into the computer and then the modified inventory (even for rooms not changed) is written back on tape. If you have disk, I suggest you set up a separate file for each room and allow for expansion of the file. This way you can update the inventory for each room.

Finally, now that you have your inventory, make a back up copy and put it in a safe place. □

Leslie Sparks, 1014 Evergreen Dr., Durham, NC 27712.

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The 1980 Business & Home Computer Shows.℗

Last year's spectacular success in Boston broadens its reach this year into the prosperous Chicago and Washington/Baltimore markets as well. The Business & Home Computer Shows are coming up again. But space is going fast. So call now if you want to be a part of the hottest thing ever in regional end-user computer expositions.

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CALL NOW! SPACE IS RUNNING LOW.

Four hundred booths and 100,000 square feet of floor space for each of the three shows may sound big, and it is. But over half that space has already been sold, mostly to last year's participants. (Several companies tried single booths last year and are back again with reservations for 12 to 16 booths!) So hurry. Call Bill Mahan or Joan Donahue at (617) 524-4547 to get more facts and assure your reservation.

WASHINGTON/BALTIMORE: D.C. Armory/Starplex, Thu., Sept. 18 thru Sun., Sept. 21.
CHICAGO: McCormick Place, Thu., Oct. 16 thru Sun., Oct. 19.
BOSTON: Hynes Auditorium/Prudential Center, Thu., Nov. 20 thru Sun., Nov. 23.

THE BUSINESS & HOME COMPUTER SHOWS

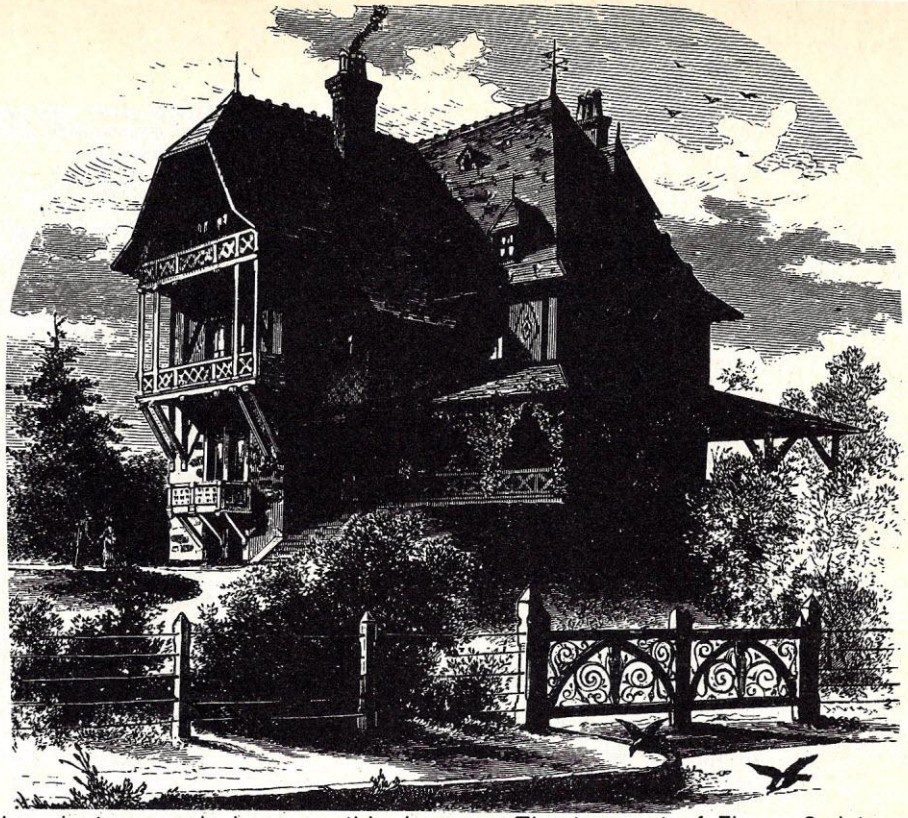
P.O. Box 678, Brookline, MA 02147

```
10 REM HOME INVENTORY PROGRAM BY L. E. SPARKS
20 REM CLEAR STRING SPACE
30 CLEAR(1000)
40 REM VARIABLE LIST--CI(I) CONSUMER PRICE INDEX FOR YEAR 1944+I
50 REM CI CONSUMER PRICE INDEX FOR CURRENT YEAR
60 REM YR CURRENT YEAR
70 REM IC YR-1944
80 REM NR NUMBER OF ROOMS
90 REM R$ NAME OF ROOM (R$(I) NAME OF ITH ROOM)
100 REM NI(I) NUMBER OF ITEMS IN ITH ROOM
110 REM I$ NAME OF ITEM (I$(I,J) IS AN ITEM NUMBER J IN ROOM # I
120 REM Y(I,J) YEAR THAT ITEM NUMBER J IN ROOM NUMBER I WAS PURCHASED
130 REM P(I,J) PRICE PAID
140 REM TP TOTAL PRICE PAID (TP(I) IS THE TOTAL PRICE FOR ROOM #I)
150 REM RC REPLACEMENT COST (RC(I) IS THE REPLACEMENT COST FOR
    ITEMS IN ROOM # I
160 REM PROGRAM STRUCTURE
170 REM SUBROUTINE INITIALIZES EVERYTHING
180 REM SUBROUTINE 2000 CREATES AN INVENETORY
190 REM SUBROUTINE 3000 DISPLAYS THE CURRENT INVENTORY
200 REM SUBROUTINE 4000 STORES THE CURRENT INVENTORY ON TAPE
210 REM SUBROUTINE 5000 READS AN INVENTORY FROM TAPE
220 REM SUBROUTINE 6000 ADD TO THE INVENTORY IN THE COMPUTER
230 REM SUBROUTINE 7000 DELETES AN ITEM FROM THE INVENTORY
240 REM TRANSFER TO SUBROUTINE 1000
250 GOSUB 1000
260 INPUT"DO YOU WANT TO CONTINUE (ANSWER Y OR N PLEASE)";Y$
270 IF Y$="N" THEN STOP
290 RUN
1000 REM SUBROUTINE TO INITIALIZE
1010 CLS
1020 PRINT"HOME INVENTORY BY L. E. SPARKS"
1030 NR=10
1040 NI=20
1050 PRINT"HOW MANY ROOMS ( ";NR;" ) IS DEFAULT";:INPUT NR
1060 PRINT" MAXIMUM NUMBER OF ITEMS IN ONE ROOM (";NI;") IS DEFAULT";:INPUT NI
1070 DIM CI(40),R$(NR),I$(NR,NI),Y(NR,NI),P(NR,NI),NI(NR),TP(NR),RC(NR)
1080 REM READ IN CONSUMER PRICE INDEX FROM DATA STATEMENT
1090 FOR L=1 TO 40
1100      READ CI(L)
1110      IF CI(L)=999 THEN GOTO1200
1120 NEXT L
1200 CLS
1210 PRINT" WHAT IS CURRENT CONSUMER PRICE INDEX (";CI;")";
1220 INPUT CI
1230 PRINT" WHAT IS CURRENT YEAR (";YR;")";
1240 INPUT YR
1250 CLS
1260 PRINT"THE CURRENT YEAR IS ";YR;" AND THE CONSUMER PRICE INDEX IS ";CI
1265 CI(YR-1944)=CI
1270 INPUT"IS THIS CORRECT ";Y$
1280 IF Y$="Y" THEN GOTO1400
1290 PRINT"REENTER INCORRECT DATA"
1300 GOTO 1210
1400  FL=0
1410 CLS
1420 PRINT"THE AVAILABLE OPTIONS ARE :"
1430 PRINT "1. CREATE AN INVENTORY"
1440 PRINT"2. READ AN INVENTORY FROM TAPE"
1450 PRINT"3. ADD TO AN INVENTORY"
1460 PRINT"4. DELETE FROM AN INVENTORY"
1470 INPUT"WHICH OPTION (1,2,3,OR 4) DO YOU WANT";OP
1480 IF OP=1 GOSUB 2000
1490 IF FL=1 THEN GOTO1800
1500 IF OP=2 THEN GOSUB 5000
1510 IF FL=1 THEN GOTO 1800
1520 IF OP=3 THEN GOSUB 6000
1530 IF FL=1 THEN GOTO 1800
1540 IF OP=4 THEN GOSUB 7000
1550 IF FL=1 THEN GOTO 1800
1560 IF OP<>4 THEN PRINT" PLEASE ANSWER WITH 1,2,3,OR 4"
1570 GOTO1400
1800 FL=0
1810 RETURN
2000 REM SUBROUTINE TO CREATE AN INVENTORY
2010 CLS
2020 PRINT"YOU HAVE SELECTED TO CREATE AN INVENTORY"
2030 J=1
2040 FOR I=1 TO NR
2045 J=1
2050    PRINT"WHAT IS NAME OF ROOM (;"R$(I)");
2060    INPUT R$(I)
2070    PRINT "NAME OF ROOM IS ";R$(I)
2080    INPUT" IS THIS CORECT ";Y$
2090    IF Y$="Y" THEN GOTO 2200
2100   PRINT"ENTER CORRECT DATA"
2110   GOTO 2050
2200 REM BEGIN LOOP FOR ITEMS IN THE ROOM
2210           PRINT"WHAT IS THE NAME OF ITEM #";J;"(";I$(I,J);") ";
2220           INPUT I$(I,J)
2230           PRINT"YEAR PURCHASED (";Y(I,J);")";
2240           INPUT Y(I,J)
2250           PRINT"PRICE (";P(I,J);")";
2260           INPUT P(I,J)
2270           PRINT I$(I,J);"PURCHASED IN ";Y(I,J);" FOR $";P(I,J)
2280           INPUT "IS THIS CORRECT";Y$
2290           IF Y$="Y" THEN GOTO 2500
2300           PRINT"REENTER INCORRECT DATA CURRENT DATA SHOWN IN ()"
2310          GOTO 2200
2500           CLS
2510           PRINT"CURRENT CONTENTS OF INVENTORY FOR ";R$(I)
2520           PRINT"ITEM","PURCHASED","PRICE$"
2530                  FOR K=1 TO J
2540                       PRINT I$(I,K),Y(I,K),P(I,K)
2550                       NEXT K
2560    J=J+1
2570    INPUT"ARE THERE ANYMORE ITEMS IN THIS ROOM";Y$
2580    IF Y$="Y" THEN GOTO 2200
2590    NI(I)=J-1
2600 NEXT I
2610 GOSUB 3000:REM PRINT OUT THE INVENTORY
2620 Y$=" "
2630 INPUT"DO YOU WANT TO SAVE THIS INVENTORY ON TAPE";Y$
2640 IF Y$="Y" THEN GOSUB4000
2650 REM OPTION FOR THOSE WITH PRINTER
2660 Y$=" "
2670 INPUT"DO YOU WANT HARD COPY";Y$:REM DELETE THIS LINE IF YOU DO NOT
     HAVE PRINTER
2680 IF Y$="Y"  THEN GOSUB 9000:REM DELETE THIS LINE IF YOU DO NOT HAVE
     A PRINTER
2690 RETURN
3000 REM SUBROUTINE TO PRINT INVENTORY ON CRT
3010 CLS
3020 FL=1
3030 Y$=" "
3040 TP=0
3050 RC=0
3060 FOR I=1TO NR
3070    CLS
3080    PRINT"INVENTORY FOR ";R$(I);" ROOM"
3090    PRINT"ITEM    ", "YR PURCHASED", "PRICE$","REPLACEMENT"
3100    RC(I)=0
3110    TP(I)=0
3120    FOR J=1 TO NI(I)
3130            IC=Y(I,J)-1944
3140            XC=INT(100*P(I,J)*CI/CI(IC))/100
3150            REM THIS ROUNDS XC TO NEAREST 0.01
3160            PRINT I$(I,J),Y(I,J),P(I,J),XC
3170            RC(I)=RC(I)+XC
3180            TP(I)=TP(I)+P(I,J)
3190    NEXT J
3200    PRINT "TOTAL PRICE PAID FOR ITEMS IN ";R$(I);" $";TP(I)
3210    PRINT "TOTAL REPLACEMENT COST $";RC(I)
3212   TP=TP+TP(I):RC=RC+RC(I)
3220    INPUT"PRESS <ENTER> TO SEE NEXT ROOM";Q
3230 NEXTI
3240 FL=1
3245 PRINT "TOTAL PURCHASE PRICE OF ALL ITEMS IS $";TP
3246 PRINT "TOTAL REPLACEMENT COST OF ALL ITEMS IS $";RC
3250 RETURN
4000 REM SUBROUTINE TO STORE DATA ON TAPE
4010 CLS
4020 PRINT CHR$(23);"READY RECORDER"
4030 INPUT"IS RECORDER IN RECORD MODE";Y$
4040 CLS
4050 HI$="HOME"
4060 PRINT"WHAT IS NAME OF INVENTORY (";HI$;" IS DEFAULT)";
4070 INPUT HI$
4080 PRINT"NAME IS ";HI$
4090 INPUT"IS THIS CORRECT";Y$
4100 IF Y$="N" THEN GOTO4060
4110 PRINT#-1,HI$,NR
4120 CLS
4130 PRINT HI$,NR
4140 FOR I=1TO NR
4150    PRINT#-1,R$(I),NI(I)
4160    PRINT R$(I),NI(I)
4170    FOR J=1 TO NI(I)
4180            PRINT#-1,I$(I,J),Y(I,J),P(I,J)
4190            PRINT I$(I,J),Y(I,J),P(I,J)
4200    NEXT J
4210 NEXT I
4220 CLS
4230 PRINT CHR$(23);"TURN RECORDER OFF"
4240 FL=1
4250 RETURN
5000 REM SUBROUTINE TO READ FROM TAPE
5010 FL=1
5020 CLS
5030 PRINT CHR$(23);"READY RECORDER"
5040 INPUT"IS RECORDER IN PLAY MODE";Y$
5050 CLS
5060 HI$="HOME"
5070 PRINT"WHAT IS NAME OF INVENTORY ";HI$;" IS DEFAULT"
5080 INPUT HI$
5090 PRINT HI$;" IS NAME OF INVENTORY"
```

```
5100 INPUT"IS THIS CORRECT";Y$
5110 IF Y$="N" GOTO 5070
5120 INPUT #-1,H$,NR
5130 IF H$<>HI$ THEN GOTO 5800
5140 FOR I=1 TO NR
5150    INPUT#-1,R$(I),NI(I)
5160    PRINT R$(I),NI(I)
5170    FOR J=1 TO NI(I)
5180            INPUT #-1,I$(I,J),Y(I,J),P(I,J)
5190            PRINT I$(I,J),Y(I,J),P(I,J)
5200 REM FOR SPEED DELETE PRINT STATEMENTS ABOVE
5210    NEXT J
5220 NEXT I
5230 IF F1=2 THEN GOTO 5900
5240 GOSUB 3000:REM GO AND PRINT INVENTORY
5250 REM FOR THOSE WITH HARDCOPY
5260 INPUT"DO YOU WANT HARDCOPY";Y$
5270 IF Y$="Y" THEN SOSUB9000
5280 INPUT"DO YOU WANT TO ADD TO THIS INVENTORY";Y$
5290 F1=1
5300 IF Y$="Y" THEN GOSUB 6000
5310 INPUT"DO YOU WANT TO DELETE ITEMS";Y$
5320 IF Y$="Y" THEN GOSUB 7000
5330 RETURN
5800 CLS
5810 PRINT H$;"<>";HI$;" YOUR OPTIONS ARE:"
5820 PRINT "1. STOP,2.CONTINUE WITH THIS INVENTORY,OR 3. TRY A NEW TAPE"
5830 INPUT"WWHICH OPTION 1,2,OR 3 DO YOU WANT";OX
5840 IF OX =2 THEN GOTO 5140
5850 IF OX =3 THEN GOTO 5000
5900 RETURN
6000 REM THIS SUBROUTINE ADDS ITEMS TO INVENTORY
6010 CLS
6020 PRINT" THIS SUBROUTINE ADD ITEMS TO INVENTORY"
6030 IF F1=1 THEN GOTO6060
6040 F1=2
6050 GOSUB 5000
6060 INPUT"WHAT ROOM DO YOU WISH TO ADD TO";R$
6070 FOR I=1 TO NR
6080    IF R$=R$(I) THEN GOTO 6200
6090 NEXT I
6100 INPUT" NOT IN INVENTORY DO YOU WISH TO TRY ANOTHER ROOM";Y$
6110 IF Y$="Y" THEN GOTO6060
6200 CLS
6210 PRINT"YOU WISH TO ADD ITEMS TO THE ";R$(I);" ROOM"
6220 PRINT "CURRENT INVENTORY IS"
6230 FOR J=1TO NI(I)
6240    PRINT I$(I,J),Y(I,J),P(I,J)
6250 NEXT J
6260 INPUT"NAME OF ITEM TO BE ADDED";I$(I,J)
6270 INPUT"YEAR PURCHASED";Y(I,J)
6280 INPUT"PRICE$";P(I,J)
6290 PRINT"YOU WISH TO ADD ";I$(I,J),Y(I,J),P(I,J)
6300 INPUT"IS THIS CORRECT";Y$
6310 IF Y$="Y" THEN GOTO 6500
6320 PRINT"REENTER INCORRECT DATA"
6330 GOTO6200
6500 J=J+1
6505 NI(I)=NI(I)+1
6510 Y$=" "
6520 INPUT"DO YOU WISH TO ADD ANOTHER ITEM TO THIS ROOM";Y$
6530 IF Y$="Y# THEN GOTO 6200
6540 Y$=" "
6550 INPUT" DO YOU WISH TO ADD ITEMS TO ANOTHER ROOM";Y$
6560 IF Y$="Y" THEN GOTO 6060
6570 GOSUB 3000
6580 Y$=" "
6590 INPUT"DO YOU WISH TO DELETE ITEMS FROM THIS INVENTORY";Y$
6600 IF Y$="Y" THEN GOSUB 7000
6610 IF F3=1 THEN GOTO6800
6620 INPUT"DO YOU WANT HARDCOPY";Y$
6630 IF Y$="Y" THEN GOSUB 9000
6640 INPUT"DO YOU WANT TO SAVE THIS INVENTORY";Y$
6650 IF Y$="Y" THEN GOSUB 4000
6800 RETURN
7000 REM THIS SUBROUTINE DELETES ITEMS FROM INVENTORY
7010 F3=1
7020 IF F1=1 THEN GOTO 7040
7025 F1=2
7030 GOSUB 5000
7040 INPUT"ROOM WHERE ITEM IS LOCATED ";R$
7060 FOR I=1 TO NR
7070    IF R$=R$(I) THEN GOTO 7200
7080 NEXT I
7090 PRINT R$;" IS NOT IN INVENTORY "
7100 INPUT"TYPE ROOM IF YOU WANT TO TRY ANOTHER ROOM,OR STOP TO QUIT";HP$
7120 IF HP$="ROOM" THEN GOTO 7040
7130 STOP
7200 FOR J= 1 TO NI(I)
7210    PRINT I$(I,J),Y(I,J),P(I,J),J
7220 NEXT J
7230 INPUT" ITEM NUMBER THAT YOU WISH TO DELETE";ID
7240 PRINT"YOU WANT TO DELETE  ";I$(I,ID);
7250 INPUT"ANSWER Y OR N";Y$
7260 IF Y$="N" THEN GOTO 7230
7270 I$(I,ID)="NULL"
7280 INPUT"IS THERE ANOTHER ITEM IN THIS ROOM TO BE DELETED";Y$
7290 IF Y$="Y" THEN GOTO 7230
7300 INPUT"DO YOU WISH TO DELETE AN ITEM IN ANOTHER ROOM";Y$
7310 IF Y$="Y" THEN GOTO 7100
7320 FOR I=1 TO NR
7330    FOR J= 1 TO NI(I)
7340            IF I$(I,J)<>"NULL" GOTO 7390
7350            I$(I,J)=I$(I,J+1)
7360            Y(I,J)=Y(I,J+1)
7370            P(I,J)=P(I,J+1)
7380            XD = XD +1
7390    NEXT J
7400    NI(I)=NI(I)-XD
7410    XD=0
7420    NEXT I
7430 REM NOW LIST NEW INVENTORY
7440 PRINT" THE INVENTORY IS NOW"
7450 GOSUB 3000
7460 INPUT"DO YOU WISH HARDCOPY";Y$
7470 IF Y$="Y" GOSUB 9000
7480 INPUT"DO YOU WISH TO SAVE THE INVENTORY";Y$
7490 IF Y$="Y" GOSUB 4000
7500 RETURN
9000 REM HARDCOPY ROUTINE
9010 LPRINT "INVENTORY FOR ";YR
9020 LPRINT "CURRENT CONSUMER PRICE INDEX IS ";CI
9025 TP=0:RC=0
9030 FOR I=1 TO NR
9035 TP(I)=0:RC(I)=0
9040    LPRINT"INVENTORY FOR THE ";R$(I);" ROOM"
9050    LPRINT"ITEM","PURCHASED","PRICE$","REPLACEMENT$"
9060    FOR J= 1 TO NI(I)
9070            IC=Y(I,J)-1944
9080            RP=INT(100*P(I,J)*CI/CI(IC))/100
9090            LPRINT I$(I,J),Y(I,J),P(I,J),RP
9100   TP(I)=TP(I)+P(I,J)
9110            RC(I)=RC(I)+RP
9120    NEXT J
9130    TP=TP+TP(I)
9140    RC =RC+RC(I)
9150    LPRINT "TOTAL PURCHASE PRICE OF ITEMS IN THIS ROOM ";TP(I)
9160    LPRINT" TOTAL REPLACEMENT COST OF ITEMS IN THIS ROOM ";RC(I)
9170 NEXT I
9180 LPRINT"TOTAL PURCHASE PRICE OF ALL ITEMS $";TP
9190 LPRINT"TOTAL REPLACEMENT COST OF ALL ITEMS $";RC
9195 RETURN
9200 REM CONSUMER PRICE INDEX DATA FROM 1945 TO 1978 1967=100
9210 DATA 53.9,58.5,66.9,72.1,71.4,72.1,77.8,79.5,80.1
9220 DATA 80.5,80.2,81.4,84.3,86.6,87.3,88.7,89.6,90.6
9230 DATA 91.7,92.9,94.5,97.2,100,104.2,109.8,116.3,121.3
9240 DATA 125.3,133.1,147.7,161.2,170.5,181.5,195,999
```

Home Buying by Computer

William Lappen



There is no doubt that the cost of buying a home has gone up dramatically in the past. Interest rates are at all time highs, too. But this may not mean that a home is a bad investment. Given the fact that you have to live somewhere, the program described in this article compares renting with purchase of a home. You may be surprised at the results.

In order to make the analysis, you must define the length of time that you would consider holding the house (or condominium) that you're considering purchasing. In Figure 1 I have assumed that the time frame is 8 years (line number 1).

```
1  YEARS 8
2  FIRST LOAN AMOUNT 80000
3  INTEREST 15
4  TERM 25 MONTHLY PAYMENT 1024.67
5  SECOND LOAN AMOUNT 25000
6  INTEREST 17
7  TERM 4  MONTHLY PAYMENT 721.38
8  PROPERTY TAX 1500
9  INSURANCE AND MISC. 2000
10  TAX BRACKET 40
11  COMPARABLE MONTHLY RENT 750
12  GENERAL INFLATION RATE 12
13  DOWN PAYMENT 25000
        CORRECT (Y/##/END) ?
```

FIGURE 1

Next comes the loans. Let's say that a bank or savings institution will loan you $80,000 to buy the house. The interest rate will be 15% and the length of the loan is 25 years. In addition, the seller will loan you $25,000 for 17% interest for 4 years. The computer takes these inputs (lines 2 through 7 on Figure 1) and computes the monthly payments for the loans.

One of the less thrilling joys of property ownership is that you will have to pay the property taxes (assumed to be $1,500 per year). Don't despair too much because this is deductible for federal tax purposes. We will cover that later.

In addition to the above costs, you will have to pay for property insurance and upkeep. This figure has been estimated at $2,000 for the first year for our hypothetical property.

After inputting your tax bracket (line 10) and guessing at the monthly rent that you would save if you owned your own house, you are ready to take a stab at predicting the inflation rate for the general economy. Good luck — economists haven't been too successful at this. The advantage to the computer analysis is that you may run it many times for different inflation rates and see what effect it will have on your potential purchase.

The final piece of information needed is the amount of money you will have to put down to buy the property that you are considering. This has been assumed to be $25,000 in our example.

Now, changes may be made to any of the input data by typing the line number. If everything is correct, type a "Y" and the computer will generate Figure 2.

The top part of Figure 2 determines the tax consequences of owning property. (Notice that numbers are expressed in hundreds in this section. This is what the "(00)" in the title means.) As a renter, you can't deduct a single thing from your taxes. As a property owner, the federal government allows you to deduct interest paid on the loans and property taxes. These are computed for the eight years that we have stated we would hold our hypothetical house. Notice that the interest portion of your loan payments decreases over time.

Moving to the second part of Figure 2, cash payments are shown. The payments are made up of the two mortgage payments, property tax and insurance payments. The first year also includes the down payment that you have to make on the house.

Next, the program calculates the tax benefits provided by the deductions. For the first year, the tax deductions are $17,400 (interest plus property taxes). This reduces income that you pay tax upon. In the 40% tax bracket, you will save $7,000 in taxes. This is a savings in actual cash and is treated as a flow of money to you.

	BUY OR RENT (00)							
	1	2	3	4	5	6	7	8
DEDUCTIONS								
INTEREST								
FIRST	120	119	119	118	117	116	115	114
SECOND	39	30	20	7				
PROP. TAXES	15	15	15	15	15	15	15	15
CASH PAYMENTS -	495	247	250	253	169	173	177	182
TAX BENEFIT +	70	66	62	56	53	52	52	52
RENT SAVING +	90	101	113	126	142	159	178	199
REAL COST	335	80	75	71	-26	-38	-53	-69

FIGURE 2

William Lappen, 10427 Lindbrook Drive, Los Angeles, CA 90024.

Home Buying, cont'd...

```
10 'RENT VS BUYING A HOME 12/12/79
20 DATA YEARS,FIRST LOAN AMOUNT,INTEREST,TERM
30 DATA SECOND LOAN AMOUNT,INTEREST,TERM,PROPERTY TAX
40 DATA INSURANCE AND MISC.,TAX BRACKET
50 DATA COMPARABLE MONTHLY RENT,GENERAL INFLATION RATE,
   DOWN PAYMENT
60 CLEAR 200
70 B$=CHR$(8)
80 B$=STRING$(4," ")+STRING$(4,B$)
90 DEFINT C,S
100 X=13
110 S=6
120 'S IS SPACING AND X IS # OF ENTRIES
130 DIM A(X+4),L(2),C(8),B(8)
140 FOR I=1 TO X+4
150 A(I)=0
160 NEXT I
170 F1=0
180 CLS
190 RESTORE
200 F=0
210 I=0
220 I=I+1
230 READ A$
240 PRINT I; " ";A$;
250 IF F1=0 INPUT A(I) ELSE PRINT  A(I)
260 IF F=0 AND I<X GOTO 220
270 F=1
280 FI=2
290 IF A(FI+1)=0 OR A(FI+2)=0 GOTO 360
300 A(X+F)=(A(FI+1)/1200)/(1-((1+(A(FI+1)/1200))
    [(-A(FI+2)*12)))*A(FI)
310 IF F=2 GOTO  360
320 IF A(5)=0 A(X+2)=0: GOTO 360
330 F=2
340 FI=5
350 GOTO 290
360 A$="MONTHLY PAYMENT"
370 PRINT @ 212, A$; INT(A(X+1)*100+.5)/100;
380 PRINT @ 404, A$; INT(A(X+2)*100+.5)/100;
390 F1=0
400 PRINT @ X*64+10, "CORRECT (Y/##/END)";B$;
410 IF A(1)>8 I=1: PRINT: GOTO 470
420 INPUT A$
430 IF A$="Y" GOTO 560
440 IF A$="END" RUN "REALESTATE"
450 I=VAL(A$)
460 IF I<1 OR I>X GOTO 400
470 RESTORE
480 FOR J=1 TO I
490 READ A$
500 NEXT J
510 PRINT A$;
520 INPUT A(I)
530 PRINT @ (X+1)*64, CHR$(30);
540 PRINT @ (I-1)*64+LEN(A$)+5, A(I);
550 GOTO 260
560 F1=1
570 CLS
580 C=A(X+1)
590 M=1
600 IF C>50 THEN M=M*10: C=C/10: GOTO 600
610 A$=STR$(M)
620 A$=RIGHT$(A$,LEN(A$)-2)
630 PRINT TAB(20) "BUY OR RENT  (";A$;")"
640 FOR I=1 TO A(1)
650 PRINT TAB(10+I*S) I;
660 NEXT I
670 PRINT
680 FOR I=1 TO A(1)
690 C(I)=0
700 B(I)=0
710 NEXT I
720 F=2
730 FI=X+1
740 FOR I=1 TO A(1)
750 IF I>A(F+2) GOTO 780
760 C=A(FI)*12/M+.5
770 C(I)=C(I)+C
780 NEXT I
790 IF F=5 GOTO 840
800 IF A(5)=1 GOTO 840
810 F=5
820 FI=X+2
830 GOTO 740
840 PRINT "DEDUCTIONS"
850 PRINT "  INTEREST"
860 F=2
870 FI=X+1
880 PRINT "    FIRST";
890 A(FI+2)=A(F)
900 FOR I=1 TO A(1)
910 IF I>A(F+2) GOTO 1010
920 D=0
930 FOR J=1 TO 12
940 L=A(FI+2)*A(F+1)/1200
950 A(FI+2)=A(FI+2)-A(FI)+L
960 D=D+L
970 NEXT J
980 C=D/M+.5
990 B(I)=B(I)+C
1000 PRINT TAB(10+I*S) C;
1010 NEXT I
1020 PRINT
1030 IF F=5 GOTO 1090
1040 F=5
1050 FI=X+2
1060 IF A(F)=0 GOTO 1090
1070 PRINT "    SECOND";
1080 GOTO 890
1090 E(1)=E(1)+A(13)
1100 PRINT "  PROP. TAXES";
1110 FOR I=1 TO A(1)
1120 B(I)=B(I)+A(8)/M
1130 PRINT TAB(10+I*S) INT(A(8)/M+.5);
1140 NEXT I
1150 PRINT
1160 PRINT
1170 PRINT "CASH PAYMENTS -";
1180 FOR I=1 TO A(1)
1190 C(I)=C(I)+INT(A(8)/M+.5)+INT((A(9)*((1+A(12)/100)
     [(I-1)))/M+.5)
1200 IF I=1 THEN C(I)=C(I)+A(13)/M+.5
1210 PRINT TAB(10+I*S) C(I);
1220 NEXT I
1230 PRINT
1240 PRINT "TAX BENEFIT   +";
1250 FOR I=1 TO A(1)
1260 C=B(I)*A(10)/100+.5
1270 PRINT TAB(10+I*S) C;
1280 C(I)=C(I)-C
1290 NEXT I
1300 PRINT
1310 D=A(11)*12/M
1320 PRINT "RENT SAVING   +";
1330 FOR I=1 TO A(1)
1340 C=D*((1+A(12)/100)[(I-1))+.5
1350 PRINT TAB(10+I*S) C;
1360 C(I)=C(I)-C
1370 NEXT I
1380 PRINT
1390 PRINT
1400 PRINT "REAL COST";
1410 FOR I=1 TO A(1)
1420 PRINT TAB(10+I*S) C(I);
1430 NEXT I
1440 PRINT
1450 PRINT
1460 PRINT
1470 INPUT "ENTER WHEN READY ";A$
1480 CLS
1490 PRINT
1500 PRINT TAB(20) "FINAL SALES INFORMATION"
1510 PRINT
1520 PRINT
1530 F$="###,###,###"
1540 A=A(2)+A(5)+A(13)
1550 A1=A*(1+A(12)/100)[A(1)
1560 A1=INT(A1/M+.5)*M
1570 PRINT TAB(10) "SALES PRICE"; TAB(40);
1580 PRINT USING F$; A1
1590 A=A1*.06
1600 PRINT TAB(10) "SELLING COMMISSION (6%)"; TAB(40);
1610 PRINT USING F$; A
1620 A1=A1-A-A(16)-A(17)
1630 A=0
1640 FOR I=1 TO A(1)
1650 A=A+C(I)*M
1660 NEXT I
1670 PRINT TAB(10) "TOTAL REAL COST ";TAB(40);
1680 PRINT USING F$; A
1690 PRINT TAB(10) "EQUITY"; TAB(40);
1700 PRINT USING F$; A1
1710 PRINT
1720 PRINT TAB(10) "TOTAL GAIN"; TAB(40);
1730 PRINT USING F$; A1-A
1740 PRINT
1750 PRINT
1760 INPUT "ENTER WHEN READY"; A$
1770 GOTO 180
```

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Home Buying, cont'd...

You will also save the rent you would have paid if you didn't buy the property. Notice that this increases each year. The increase is based on the inflation rate that you predicted. (Inflation also affects the insurance and maintenance expense you will have to pay each year. This is figured into the cash payments.)

The result of paying out the cash and receiving the savings gives you the real cost of owning the house. Our hypothetical house cost us $33,500 the first year and $8,000 the second . . . (Remember, the first year includes the down payment.) By the fifth year, we would actually start saving money by owning the house as opposed to renting.

This doesn't look that great. However, the most obvious difference in renting and purchasing is that after eight years of renting, you have nothing but rent receipts. After eight years of owning this hypothetical house, we would have a large equity. If the house's value keeps up with inflation (which is very likely based on past experience), the house will be worth about $321,900 in eight years (see Figure 3).

FINAL SALES INFORMATION	
SALES PRICE	321,900
SELLING COMMISSION (6%)	19,314
TOTAL REAL COST	37,500
EQUITY	227,116
TOTAL GAIN	189,616

FIGURE 3

In order to get this money you may either refinance the house (increase your loans) or sell it. This analysis assumes that the house is sold and the broker gets a six percent commission ($19,314 in this case). Since the house has cost us $37,500 more than renting would have cost, this must be recovered from the $227,116 equity we have in the house (the first mortgage still has 17 years to go and we would owe $75,479 on it).

Thus, the total gain from purchase rather than rent is approximately $190,000. This should just about make you rush right out to purchase a house. Be sure that you analyze each house (these hypothetical figures probably won't reflect your exact situation). Also, run the program with changes in the different input assumptions. This will give you a feel for the sensitivity of the variables on the final outcome. If you are not interested in buying a house yet (or already own one), see if some local real estate brokers might be interested in having this analysis available to give to their prospective buyers. It should certainly help sales.

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CIRCLE 221 ON READER SERVICE CARD

Retirement and the Arithmetic of Inflation

Carl E. Whitney

Inflation puts many retired people in a difficult position. Since Social Security and pensions usually aren't enough to pay expenses, these people must spend some of their investment income on day-to-day needs. But next year's income won't buy as much, and eventually the invested principal will have to be tapped; in effect, this amounts to living off savings, and it is only a matter of time until the money runs out. When will this happen? The following BASIC program solves this straightforward recursive problem. It may cause some distress among the inflation-naive, who don't understand that we are well on the way to a tenfold increase in prices by the end of the century.

The problem is not inflation but the relationship between interest rates and the rate of inflation.

Actually, the problem is not inflation but the relationship between interest rates and the rate of inflation. Suppose that the latter is twelve percent. After paying income tax, the holder of a bank account must increase the size of his or her account by twelve percent each year, if the account is to keep its purchasing power. Real, spendable income is what remains after this set-aside. But "paper assets" such as stocks, bonds and bank accounts have not consistently supported such real income over the last fifteen years. (To determine the amount of real income, the program multiplies total assets by the difference between the rate of return on assets and the rate of inflation. Social Security is added to the result, and expenses are subtracted.)

Projecting today's conditions far into the future is hypothetical, of course, but there is little reason to think that things will get better and not worse. Thus, the program is a valuable analytic tool. An asset lifetime of less than ten years should be cause for concern; either expenses are too high, or investment income is too low, or both. An interesting feature of this asset decay is that total assets appear to rise for a time, only to be suddenly consumed by the ballooning cost of living.

How is the calculation done? Clearly, next year's assets are this year's assets plus income minus expenses. Social Security is indexed for inflation, so that next year's payments must be adjusted. Expenses will rise at the rate of inflation. Most pensions are not indexed; if the retiree has a partially indexed pension, it should be added to Social Security to the extent that it is indexed. (For example, suppose that a specific pension has tended to rise at half the rate of inflation. Half the monthly payments should be added to Social Security before entry; the other half should be entered as a pension.)

Will property and income taxes rise at the rate of inflation? The program assumes that they will, though this assumption may break down as the retiree's assets and income shrink. It might be more realistic to assume that income taxes will be proportional to income, or to assets. Trial runs, however, show that the final answer would not change drastically under this assumption. Until Congress indexes the income tax, it's sufficiently precise to lump taxes with other expenditures.

So much for the easy part. The market value of a common stock is known, but what is the rate of return here? A pessimistic guess is simply the yearly dividends. A more optimistic figure is the stock's earnings per share (times the number of shares held; EPS figures appear in the firm's annual report). The most optimistic approach allows for expected growth in the company's earnings.

The retiree's personal residence should be ignored; the program then gives the point at which this is the only remaining asset. Rental property can be entered as an asset, but the problem of return again pops up. One estimate of the return is the expected appreciation of the property, plus the net profit as reported on the latest income-tax return.

The program does not allow for debts. This should cause few problems, except in the case of a large mortgage on a personal residence. The mortgage payment is not like other expenses — it will not increase with inflation, it ends at some point, and part of it is not an expense at all, since it builds equity. This situation cannot be handled without major modifications to the program.

For people who don't know their monthly expenses, an alternative computation is provided. But it's tricky, and must be done carefully. Over any fixed period — the program uses three months, the interval at which banks pay interest and report account balances — expenses are equal to income minus net change in total assets. It's

Best case/Worst case Assumptions

Input Variable	Optimistic Treatment	Pessimistic Treatment
Rate of inflation	Underlying rate, or official government forecasts	Recent Consumer Price Index rate
Rate of return on:		
Bank accounts, money market funds	current rate	
Bonds	Actual payments, from which the program will calculate the rate. Use current market value for "value of asset." (More accurately, use the yield-to-maturity as found in Standard & Poor's Bond Guide.)	
Common stocks	Expected yearly growth in earnings-per-share, plus current "earnings yield" (EPS divided by stock price)	Annual dividends, or "dividend yield"
Rental property	Current net profit plus expected appreciation	Current net profit plus less optimistic estimate of appreciation
Gold and collectibles	Expected appreciation	Less optimistic estimate

Carl E. Whitney, 846 Bush Street #3, San Francisco, CA 94108.

always a good idea to tabulate assets as of the beginning of each calendar quarter.

Finally, there is the question of inflation. At this writing, the U.S. Consumer Price Index is rising at an annual rate of twelve percent. But the underlying or "imbedded" rate is probably closer to ten percent. One approach is to use a best case/worst case analysis, as summarized in the accompanying table. The rate of inflation can be changed and the program rerun without reentry of the other variables.

The program presently runs on a 16K PET, but should run on any machine with floating point arithmetic and 8K of memory. It may be illegible if the computer's text line is less than forty characters. Its assumptions may not hold outside the United States.

Summary of Sample Run

Total assets: $52,300
Return on assets: 10.14%
Inflation: 12%
Social Security: $310 per month
Pension: $140 per month
Expenses: $515 per month
Taxes: $600 per year

Assets will be consumed in 21 years. The inflation rate is not too critical; a rerun with inflation set to 10% gives an asset lifetime of 25 years.

Note that this widow's "income," as the word is usually understood, currently exceeds her outgo by almost $4000 per year. But real income and apparent income are two different quantities, a fact which the program should dramatize.

In this writer's judgment, an asset lifetime of twenty or thirty years is neither totally satisfactory nor hopelessly grim. What can be done here? The woman, who now rents an apartment, might buy a house; such a move, if thoughtfully executed, not only shields money from inflation, but also reduces income tax. A foray into common stocks or investment real estate might be appropriate, though potential risks must be weighed carefully. □

```
10 A=0
15 I=0
17 PRINT "WRITE DOWN ALL ENTRIES FOR LATER USE"
20 PRINT "ENTER ASSETS ONE BY ONE,AS FOLLOWS"
22 PRINT
24 PRINT "VALUE OF ASSET,YIELD"
26 PRINT
28 PRINT "YIELD CAN BE EITHER PERCENT OR DECIMAL"
30 PRINT "10000,12 MEANS 12% RETURN ON $10,000
32 PRINT "10000,.12 MEANS THE SAME"
34 PRINT
36 PRINT "IF THE ANNUAL YIELD IS MORE THAN $100,"
38 PRINT "IT MAY BE ENTERED DIRECTLY"
40 PRINT "2000,180 MEANS $180 YEARLY INCOME"
42 PRINT "ON AN INVESTMENT OF $2000"
43 PRINT
44 PRINT "WHEN THRU,ENTER 2 ZEROES"
100 INPUT X,Y
105 IF X=0 THEN 185
110 IF Y>100. THEN 160
120 IF Y<1 THEN 140
130 Y=Y*.01
138 REM FIND ANNUAL RETURN FROM DECIMAL YIELD
140 Z=X*Y
150 GOTO 175
158 REM FIND DECIMAL YIELD FROM ANNUAL RETURN
160 Z=Y
170 Y=Z/X
173 REM ACCUMULATE ASSETS,RETURN
175 I=I+Z
176 A=A+X
178 PRINT "$";INT(X);" AT ";100*Y;"% = $";INT(Z);" YEARLY"
180 GOTO 100
182 REM RATE OF RETURN =     TOTAL    RETURN /TOTAL ASSETS
185 R=I/A
190 PRINT "TOTAL ASSETS = $";INT(A)
192 PRINT "RATE OF RETURN = ";100*R;"%"
194 PRINT "TOTAL RETURN = $";INT(I)
200 PRINT
205 PRINT "EXPECTED RATE OF INFLATION=";
210 INPUT F
220 IF F<1 THEN 240
228 REM CONVERT PERCENT TO DECIMAL
230 F=F*.01
240 PRINT "MONTHLY SOCIAL SECURITY = ";
250 INPUT S
260 PRINT "MONTHLY PENSIONS"
261 PRINT "(NOT INDEXED FOR INFLATION) = ";
270 INPUT P
280 PRINT "MONTHLY EXPENSES (NOT INCLUDING TAXES)"
285 PRINT "IF UNKNOWN, ENTER ZERO"
290 INPUT E
295 IF E>0 THEN 390
301 REM CALCULATE MONTHLY EXPENSES
308 PRINT "ASSETS AS OF 3 MONTHS AGO,FOR BANK"
309 PRINT "ACCOUNTS,MONEY MARKET FUNDS,ETC,"
310 PRINT "USE BALANCE FROM QUARTERLY STATEMENT."
311 PRINT "FOR STOCKS,BONDS,REAL ESTATE,ETC,"
312 PRINT "USE EITHER CURRENT MARKET VALUE OR"
313 PRINT "VALUE 3 MONTHS AGO. ENTER ONE BY ONE,"
319 REM CALL INPUT ROUTINE
320 GOSUB 700
325 AA=Y
335 PRINT "TOTAL INCOME DURING THE 3 MONTHS, PLUS"
336 PRINT "UNREALIZED GAIN (OR LOSS) ON STOCKS,ETC"
337 PRINT "(UNREALIZED GAIN = VALUE ENTERED AT"
338 PRINT "PROGRAM START MINUS VALUE JUST ENTERED)"
340 GOSUB 700
350 II=Y
360 PRINT "TAXES PAID DURING THIS TIME, OR OTHER"
361 PRINT "UNUSUAL OR ONCE-A-YEAR EXPENSES"
365 GOSUB 700
366 TT=Y
370 PRINT "ASSETS THEN = $"; INT(AA)
371 PRINT "ASSETS NOW = $"; INT(A)
372 PRINT "3 MONTH INCOME = $"; INT(II)
373 PRINT "TAXES PAID = $"; INT(TT)
374 REM DELETE NON-MONTHLY EXPENSES
376 AA=AA-TT
378 REM EXPENSES =     INCOME MINUS CHANGE IN ASSETS
379 REM ADJUSTED TO MONTLY BASIS
380 E=(II-(A-AA))/3
385 PRINT "MONTHLY EXPENSES = $";INT(E)
386 PRINT "VERIFY THAT THIS NUMBER IS REASONABLE"
387 PRINT "**************************************"
388 PRINT
389 REM REJOIN MAIN FLOW OF PROGRAM
390 PRINT "ANNUAL INCOME AND PROPERTY TAXES,"
391 PRINT "AND OTHER ONCE-A-YEAR EXPENSES"
393 GOSUB 700
395 TT=Y
397 PRINT "TOTAL TAXES, ETC = $";INT(TT)
398 REM ANNUALIZE NUMBERS. CONVERT RATES TO CONVENIENT
399 REM FORM. CHANGE VARIABLE NAMES TO SIMPLIFY PROGRAM
400 REM MOD AND INPUT RETRIEVAL. INITIALIZE YEARS
405 SX=12*S
410 PX=12*P
420 EX=12*E+TT
430 FX=F+1
440 RX=R+1
450 AX=A
460 Y=0
463 REM VERIFY THAT POSITION IS UNSTABLE. DO EXPENSES
464 REM EXCEED REAL INCOME?
470 II=(R-F)*A+SX-EX
480 IF II<0 THEN 500
490 PRINT "THIS POSITION IS STABLE. REAL MONTHLY"
491 PRINT "INCOME IN EXCESS OF EXPENSES = $";INT(II/12)
495 GOTO 600
500 PRINT
510 PRINT "YEAR", "ASSETS"
515 PRINT
517 REM LOOP . CALCULATE NEXT YEAR'S ASSETS
520 Y=Y+1
530 AX=AX*RX+SX+PX-EX
540 PRINT INT(Y),INT(AX)
548 REM INFLATE SOCIAL SECURITY, EXPENSES
550 SX=SX*FX
560 EX=EX*FX
570 IF AX>0 THEN 520
600 PRINT "TO RERUN, ENTER A DIFFERENT"
610 PRINT "INFLATION RATE. TO END, ENTER ZERO"
620 INPUT F
630 IF F=0 THEN 1000
635 IF F<1 THEN 405
640 F=F*.01
645 GOTO 405
699 REM CUMULATIVE INPUT SUBROUTINE
700 Y=0
710 PRINT "ENTER ZERO WHEN THRU"
715 INPUT X
720 IF X=0 THEN 735
725 Y=Y+X
730 GOTO 715
735 RETURN
1000 END
```

Comments on Checkerboard Problem Solved

Abijah Reed

Here are some comments on the article "Checkerboard Problem Solved" in the January issue.

Several of the solutions printed for the N = 4 case do not conform to the requirement that there be exactly one checker on each main diagonal.

I believe there is a more efficient way to find solutions exhaustively than that alluded to by Steve North. For every solution, each checker has a row number and a column number which describe where the checker is. We can arbitrarily assign the number 1 to N as the row numbers in every successful solution, and then our problem is reduced to finding the column numbers. Any permutation (of which there are N!) of the numbers 1 to N can be used as a set of column numbers, and then we will *almost* have a solution. The only condition not yet accounted for is the one-checker-per-diagonal condition. In any case, this procedure only requires that we check N! cases, not

$$\frac{N2!}{N!(N2-N)!}$$

For N = 8, N! is smaller than this expression by a factor of more than 100,000.

I am enclosing a listing of a program to find correct solutions, and either count or print them. The program simply generates the permutations of column numbers, and screens out those that don't meet the diagonal condition. The screening is done on line 2 of the function 'CKBD'.

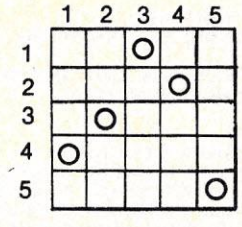
A final remark: many of the solutions found by these procedures are simply rotations and/or reflections of each other. All 8 solutions for N = 4 are fundamentally the same. For N = 5, the 20 solutions generated contain only 4 that are distinct.

I haven't thought much about a program to generate only distinct solutions, but some of your readers might enjoy that problem. □

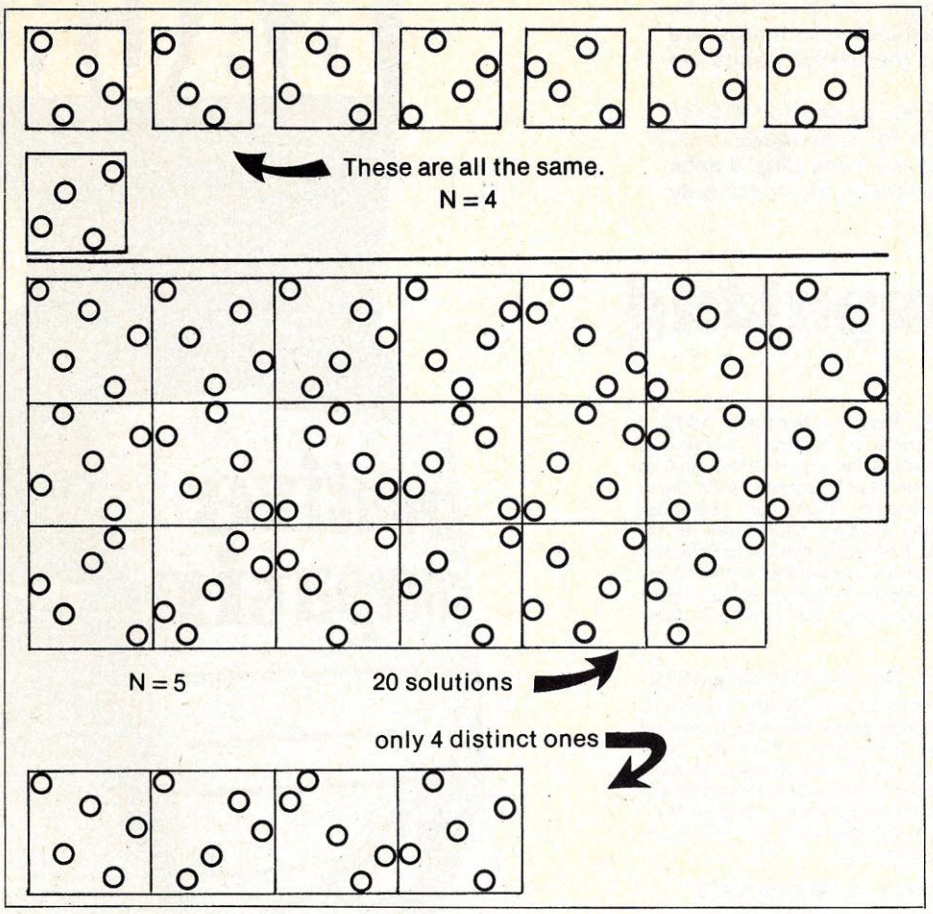
```
      ∇CKBD[□]∇
      ∇ Z←A CKBD N;P;K
[1]     P←⍳N ◇ K←0
[2]   L2:→((1≠+/P=⍳N)∨1≠+/(P+⍳N)=N+1)/L1
[3]     →(A='C')/L3
[4]     P ◇ →L1
[5]   L3:K←K+1
[6]   L1:P←PERM P
[7]     →(1≠⍴P)/L2
[8]     →(A='P')/0
[9]     'NO. OF SOLUTIONS: ',▼K
      ∇

      ∇PERM[□]∇
      ∇ Z←PERM V;N;B;S;T;J;C;I
[1]   N←⍴V ◇ B←¯1↓V<1⌽V ◇ I←N-(⌽B)⍳1
[2]   →(0≠I)/L1 ◇ Z←0 ◇ →0
[3]   L1:S←V[I] ◇ T←⌊/(C>S)/C←(-(N-I))↑V
[4]     J←V⍳T ◇ V[I]←T ◇ V[J]←S ◇ V←(I↑V),C[⍋C←(-(N-I))↑V]
[5]     Z←V
      ∇


      'C' CKBD 3
NO. OF SOLUTIONS: 0

      'P' CKBD 4
1 3 4 2
1 4 2 3
2 3 1 4
2 4 3 1
3 1 2 4
3 2 4 1
4 1 3 2
4 2 1 3

      'P*
        ' CKBD 5
1 3 5 2 4
1 4 2 5 3
1 4 5 3 2
1 5 4 2 3
2 1 3 5 4
2 3 5 4 1
2 4 1 3 5
2 5 3 1 4
3 1 4 2 5
3 2 4 5 1
3 4 2 1 5
3 5 2 4 1
4 1 3 5 2
4 2 5 3 1
4 3 1 2 5
4 5 3 1 2
5 1 2 4 3
5 2 1 3 4
5 2 4 1 3
5 3 1 4 2

      'C' CKBD 6
NO. OF SOLUTIONS: 96
```

only these 4 are distinct

example



Abijah Reed, 225 Thoreau St., Concord, MA. 01742



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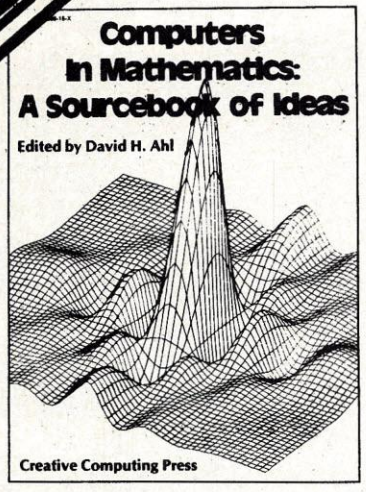

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Vol. 4, No. 6—Nov/Dec 1978
Subject index and file index in BASIC, consumer computers buying guide, electronic game reviews, critical path analysis, mailing label programs, robot programming, experiment in teaching strategic thinking, evaluations of Northstar Horizon, CP/M operating system and backgammon computers, columns on Apple II PET and TRS-80, plus game section including "Corral", "Joust" and Puzzle"

Vol. 5, No. 1—January 1979
Computers in fiction; Survey of Educator's Attitudes; K-State; How to Hide Your Basic Program; World Chess Championship Computer; Compleat Computer Catalog, Microchess for the TRS-80; Exidy Sorcerer; Ohio Scientific superboard II; Robots in Fiction; Help for the Weary Taxpayer; A counterfeit Cursor for your PET; Medical Audit Time.

Vol. 5, No. 2—February 1979
Evaluations: Electric Pencil, Heathkit H-8, Computer Music Records. Computer Games: Gold Mine, Atom-20. Computerized Sports Predictions, Multiple Regression Analysis Simplified, Value of Computers in Education, Budget Management System, Help for the beleaguered consumer.

Vol. 5, No. 3—March 1979
Six articles on data base management; Evaluations of TRS-80 and Apple Disk Systems; Payroll system; the Game of Go; Small business computing with the Sourcerer; Judging of sports events; Social Science survey program.

Vol. 5, No. 4—April 1979
Safeguarding your computer; Interpretive programming; Elements of a good computer game, Music composition; "What will happen if"; Vertical graphs and bar charts; People Programming; Home applications.

Vol. 5, No. 5—May 1979
Word processing systems — buying a system and 5 evaluations; Writing 2 user-oriented program; Tutorial on PILOT; 3 new games; Amoritization schedules, reading and comprehension tests.

Vol. 5, No. 6—June 1979
8 Articles on computer graphics and plotting; Evaluations: HiPlot, NAD System, ALF/Apple Music Synthesizer; Copyright of Software; Sesame Place; Probability Study; String Manipulations; 3 New Games.

Vol. 5, No. 7-July 1979
Two Ecology Simulations, Creativity Test; World Power Systems; Files and Data Basis — 4 Articles; Evaluations of Six Peripherals and Software Systems; Personal finance Model, 2 logic games.

Vol.5, No. 8 August 1979
Adventure, Computers and Dance, Can Computers Think? The Law and Your Computer, muMath, Image Processing, Manipulating Pencil Files, Structured Programming Techniques. Evaluation of TI99/4, TRS-80 Model II, SWTPC PR-40, IMSAIVIO. Games: HVOLT and Fort.

ISSUES

Vol.5, No. 10 October 1979
Battle of the Word Processors, The Computer as a Gun, Computer Driven Real 3-D Display. Applications: RCA VIP and COSMAC ELF* Graphics Digital Clock. Evaluations: Peripheon 511, Compucolor II, Health H14 Printer, Atari Video Computer Cartridges, Mountain Hardware SuperTalker.

Vol.5, No. 11 November 1979
Comparison Chart of Six Popular Personal Computers, Comparison of Single Board Computers, Electronic Toys and Games, Quick Printer II, Interact Computer, TRS-80 Level III Basic, Battle of the Word Processors, IntrolX-10 Home Control System, Adventure: Complete Listing in Basic, Build Your Own Telephone Dialer and Joysticks.

Vol.5, No. 12 December 1979
More Electronic Games, Language Translators, APFMP1000 Video Game System, Buying a Word Processor printer, Satellite Tracking Software, Syskit for the 8080, Assemblers: CP/M vs. TSC, Statistics for the TRS-80. Part 2: Controlling Household Devices, Computerized Biofeedback. Applications: The Microcomputer as an Investment Tool, "Turnkey" CP/M systems, Animation for the Apple. Digitized Video Images.

Volume 6, No. 1 January 1980
Interviews with Donald E. Knuth and William Wulf; Six Features on Artificial Intelligence; Air Traffic Controller; Computerized Resume; GROW: A Program that Learns; Evaluations: Six Basics; NEWDOS and TRSDOS; Auto Scribe; Micro Music.

Volume 6, No. 2 February 1980
Six articles on Investment Analysis; David Levy: Intelligent Computer Games; Programs: Geneology, Graphing, Genetics; Evaluations of Word Star vs Electric Pencil; Pascal for the TRS-80; Micro Composer; Data Dubber; Sorcerer Word Processing Pac; Trivia Contest Results.

Volume 6, No. 3 March 1980
Evaluations: TI 99/4; Cobol: Microsoft vs Micro Focus; Pencil Sharpener; Mailroom Plus; Ten software packages; Networks for Personal Computers; Three Mile Island Game; Interview with Joel Birnbaum; How to Make a Basic Tree.

ROM

July 1977
SOL. The Inside Story; Braille and the Computer Video newspaper; A Chip is Born; The Care and Feeding of Your Home Computer; Digital Foam — the peripheral of the future.

August 1977
The Kit and I, Part I, by someone who's never soldered before; Introduction to the fundamentals of Computer Memory; Tips for the do-it-yourself hardware beginner; Binary clocks; APLomania.

September 1977
Xeroxes and other hard copy off your CRT; Payroll Program; How Computers Work; The Kit and I, Part II: or Power to the Computer; CCD's How They Work and How They're Made; A look at PLATO, an Educational Computer System; IBM 5100.

October 1977
Binary Arithmetic For the Beginner; Microprocessor Aid for the Deaf and Blind; The Kilobyte Card; Scott Joplin on Your Sci-Fi Hi-Fi; Building a Basic Music Board; Flowcharting; Payroll Program.

November 1977
Solar Energy Measurement; A Beginners Introduction to BASIC; The Kit and I, Part III; More Music to Play on Your Computer; Micro Maintenance; Solomon and Viet: Putting Together a Personal Computing System; Time Sharing on the Family MICRO.

December 1977
A Beginners Guide to Peripherals; The Best Slot Machine Game ever; Artificial Intelligence?; An Electronic Jungle Gym for Kids; File Copy Program; Better Health Through Electronics; the Kit and I Part IV.

January 1978
Synthetic Skin for Your Robot and How to Make It; TLC: A Visual Programming Language; The Code That Can't Be Cracked; Beginners Guide to Computer Graphics; The Computer and Natural Language; First-Timer's Guide to Circuit Board Etching.

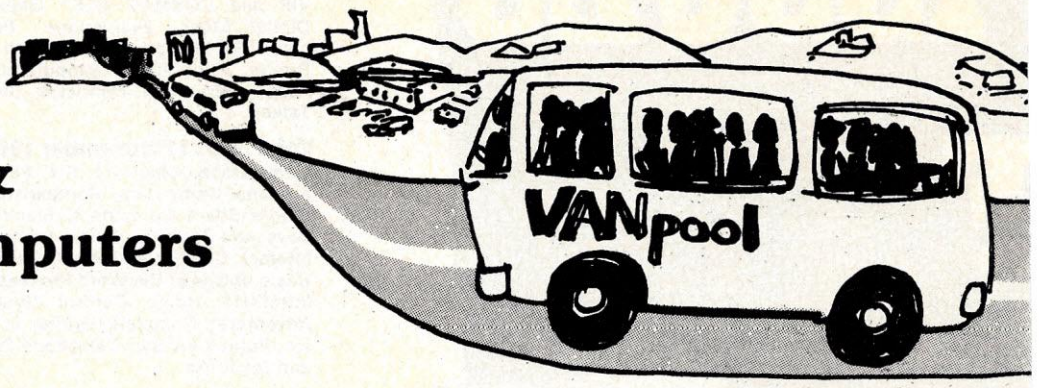
February 1978
A Practical Mailing List Program; Artificial Intelligence; Assemblers; Flowgrams—A New Programming Tool; Refresher Course in BASIC; Micros and Analyzing Election Results; Upgrading Your BASIC.

March-April 1978
Introduction to real time concepts; Felsenstein: An Absolute-Time Clock; Dreyfus: Things Computers *Still* Can't Do; Introduction to Interpreters; Othello Games; Weizenbaum: Incomprehensible Programs; The Quasar Robot Revealed; Chesson: Cryptanalysis.

Send order to Creative Computing, P.O. Box 789-M, Morristown, NJ 07960. Or save time and call your credit card order toll. free to: **800-631-8112** (in NJ, 201-540-0445).

Update:

Car Pooling & Personal Computers



John Craig

In the November, 1979 issue of Creative Computing we published a rather lengthy article on using personal computers to establish car pool systems in small and medium-sized towns across the country. In addition to providing a valuable community service, especially in these energy-troubled times, I wanted to show how operating such a system could also be a good source for primary or secondary income. Unfortunately, my efforts in trying to locate sources for federal or state funding were fruitless. And, that kind of funding does seem to be the only way to finance a personal computer ride matching service. The article also provided specifications for software for such a system. A ray of hope has broken through the cloudy skies and it looks like we have answers to both the funding and software obstacles.

I sent a copy of the article to my Congressman, Robert Lagomarsino, and asked his help in getting the answers I felt were still in the Department of Energy and Transportation. He definitely proved to be the right leverage for getting the information. The response from the two government agencies proved to be very helpful and courteous. I also sent a copy of the article to the White House because of President Carter's October 25th announcement of increased federal activity in car and van pooling. Apparently that move provided some additional leverage.

In this month's issue we have a review of the Universal Data Entry program from The Software Store. Rich Didday wrote the article and used the car pooling program specs as an example of how the data base could be used. There are other general-purpose data base programs, as well as specialized programs, which could be used for this application. This example is a step in the right direction. Getting some of these systems funded and operational would certainly be a step in the right direction.

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
WASHINGTON, D.C. 20590

NOV 16 1979

IN REPLY REFER TO:

HHP-33

Honorable Robert J. Lagomarsino
House of Representatives
Washington, D.C. 20515

Dear Mr. Lagomarsino:

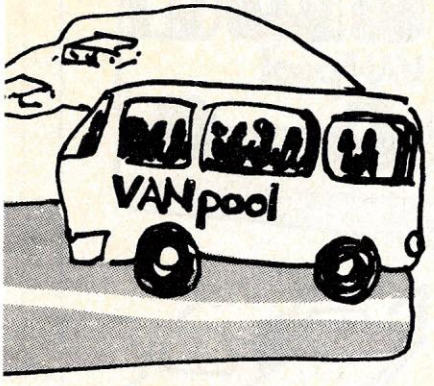
This is in response to your letter of November 1 to Federal Highway Administrator Karl S. Bowers transmitting a letter of October 24 to you from your constituent, Mr. John Craig, requesting information on Federal funding for carpool computer matching systems.

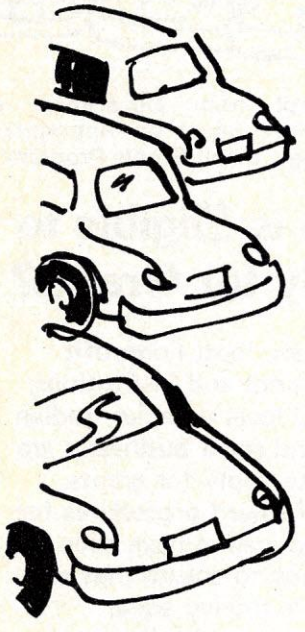
As Mr. Craig mentioned on page 6 of his article, "Car Pooling and Personal Computers," Federal funds are available for carpool computer matching activities. Federal-aid highway funds can participate in these matching activities and other ridesharing activities, as described on pages 12-13 of the enclosed transportation system management (TSM) publication. The decision to use Federal-aid funds for ridesharing activities is made by the State and, with respect to Urban System funds, State and local officials.

There is a division office of the Federal Highway Administration (FHWA) in each State. The Division Administrator in each office can provide advice on the use of Federal-aid funds for ridesharing activities. A list of the addresses and telephone numbers for each FHWA division office is contained in the enclosed publication "Community Ridesharing: A Leadership Role." The Division Administrator can also refer interested persons to representatives of the State transportation agency and the local metropolitan planning organization for further information.

Sincerely yours,

Thomas M. Downs
Associate Administrator
for Planning





Following is an excerpt from the TSM (Transportation System Management) booklet from the U.S. Department of Transportation, Federal Highway Administration:

Federal-aid Primary, Secondary, and Urban System funds can be used for a wide range of activities to encourage and promote carpooling and vanpooling. Federal-aid funds can participate in 75 percent of the project cost. Ridesharing activities need not be restricted to any Federal-aid highway system.

Federal-aid funds cannot be used for projects which will encourage substantial numbers of transit users to switch to carpools or vanpools.

Specific costs related to the following types of activities which encourage and promote ridesharing are eligible for funding.

- Systems, manual or computerized, for locating and informing participants of potential carpools, vanpools, or buspools.
  - —Computer hardware and software costs.
  - —Related installation costs (including labor).
  - —Specialized procedures to serve the elderly and handicapped.

Where To Go For Help

Specific information on ridesharing and help in starting a ridesharing program in your state or local area can be obtained from the Federal Highway Administration Division offices in your state. A list of their addresses, and telephone numbers follows.

FHWA Division Offices

ALABAMA
441 High Street
Montgomery, Alabama 36104
Tel. 205-832-7370

ALASKA
Federal Building
709 W. Ninth Street
P.O. Box 1648
Juneau, Alaska 99802
Tel. 907-586-7418

ARIZONA
3500 N. Central Ave.
Suite 201
Phoenix, Arizona 85012
Tel. 602-261-6675

ARKANSAS
Federal Office Bldg.
Room 3128
700 West Capitol Ave.
Little Rock, Arkansas 72201
Tel. 501-378-5625

CALIFORNIA
Federal Bldg., 2nd Fl.
801 I Street
Sacramento, California 94814
Tel. 916-440-2428

COLORADO
P.O. Box 25406
Denver Federal Center
Bldg. 25, Rm. B-2903
Denver, Colorado 80225
Tel. 303-234-4425

INDIANA
Room 254
575 N. Pennsylvania St.
Indianapolis, Indiana 46204
Tel. 317-269-7474

IOWA
105 Sixth Street
Ames, Iowa 50010
Tel. 515-233-1664

KANSAS
444 SE. Quincy Street,
Room 240
Topeka, Kansas 66683
Tel. 913-295-2550

KENTUCKY
John C. Watts Federal
Building and
U.S. Courthouse
330 W. Broadway
Frankfort, Kentucky 40602
Tel. 502-227-7321

LOUISIANA
Federal Building,
Room 239
750 Florida Street
Baton Rouge,
Louisiana 70801
Tel. 504-389-0244

MAINE
Federal Building, U.S.
Post Office
40 Western Avenue,
Room 614
Augusta, Maine 04330

MARYLAND
The Rotunda, Suite 220
711 West 40th Street
Baltimore, Maryland 21211
Tel. 301-962-4440

CONNECTICUT
990 Wethersfield Ave.
Hartford, Connecticut 06114
Tel. 203-244-2410

DELAWARE
Federal Office
Bldg., 2nd Floor
300 South New Street
Dover, Delaware 19901
Tel. 302-678-5616

DISTRICT OF COLUMBIA
McLachlen Building,
Room 1000
666 11th Street, NW
Washington, D.C. 20001
Tel. 202-724-3379

FLORIDA
Ackerman Building
223 W. College Avenue
Tallahassee, Florida 32301
Tel. 904-224-8111

GEORGIA
1422 W. Peachtree St.,
Suite 700
Atlanta, Georgia 30309
Tel. 404-881-4751

HAWAII
Prince Jonah
Kuhio Kalanianaole
Federal Building
300 Ala Moana Blvd.,
Room 4119
Honolulu, Hawaii 96813
Tel. 808-546-5150

ILLINOIS
320 Washington St.
Springfield, Illinois 62701
Tel. 217-525-4600

MASSACHUSETTS
100 Summer Street
Suite 1517
Boston, Massachusetts 02110
Tel. 617-223-2879

MICHIGAN
Federal Building,
Room 211
315 West Allegan St.
P.O. Box 10147
Lansing, Michigan 48901

MINNESOTA
Metro Square Building,
Suite 490
Seventh & Robert Sts.
St. Paul, Minnesota 55101
Tel. 612-725-7001

MISSISSIPPI
666 North Street,
Suite 105
Jackson, Mississippi 39202
Tel. 601-969-4215

MISSOURI
209 Adams Street
P.O. Box 148
Jefferson City,
Missouri 65102
Tel. 314-636-7104

MONTANA
Federal Office Building
301 S. Park,
Drawer 10056
Helena, Montana 59601
Tel. 406-449-5306

NEBRASKA
Federal Building,
Room 487
100 Centennial Mall
North
Lincoln, Nebraska 68508
Tel. 402-471-5000

NEVADA
Suite 300
1050 E. William Street
Carson City, Nevada 89701
Tel. 702-885-5320

NEW HAMPSHIRE
Federal Building,
Room 219
55 Pleasant Street
Concord, New
Hampshire 03301
Tel. 603-224-3385

NEW JERSEY
Suburban Square Bldg.
2nd Floor
25 Scotch Road
Trenton, New Jersey 08628
Tel. 609-989-2288

NEW MEXICO
117 U.S. Court House
Santa Fe, New Mexico 87501
Tel. 505-988-6255

NEW YORK
Leo W. O'Brien Federal
Building, 9th Floor
Clinton Avenue and
North Pearl Street
Albany, New York 12207
Tel. 518-472-3616

RHODE ISLAND
Federal Building and
U.S. Post Office
Exchange Terrace,
Suite 250
Providence, Rhode
Island 02903
Tel. 401-528-4541

SOUTH CAROLINA
Suite 203
2001 Assembly Street
Columbia, South
Carolina 29201
Tel. 803-765-5411

SOUTH DAKOTA
P.O. Box 700
Federal Office Building
Pierre, South Dakota 57501
Tel. 605-224-7351

TENNESSEE
Federal Building,
U.S. Courthouse
801 Broadway,
Room A-926
Nashville, Tennessee 37203
Tel. 615-251-5394

TEXAS
826 Federal Office
Building
300 East Eighth Street
Austin, Texas 78701
Tel. 512-397-5511

UTAH
Federal Building
125 South State Street
Salt Lake City, Utah 84111
Tel. 801-524-5141

NORTH CAROLINA
310 New Bern Avenue
P.O. Box 26806
Raleigh, North
Carolina 27611
Tel. 919-755-4346

NORTH DAKOTA
Federal Building
P.O. Box 1755
Bismarck, North
Dakota 58501
Tel. 701-255-4011

OHIO
200 North High Street
P.O. Box 15008
Columbus, Ohio 43215
Tel. 614-469-6896

OKLAHOMA
Federal Office Building
Room 454
200 N.W. Fifth Street
Oklahoma City,
Oklahoma 73103
Tel. 405-231-4624

OREGON
The Equitable Center
Suite 100
530 Center Street, NE
Salem, Oregon 97301

PENNSYLVANIA
228 Walnut Street
P.O. Box 1086
Harrisburg,
Pennsylvania 17108
Tel. 717-782-2222

PUERTO RICO
Federico Degetau
Federal Bldg.
Carlos E. Chardon Ave.
Hato Rey, Puerto Rico 00918
Tel. 809-753-4232

VERMONT
Federal Building
Montpelier, Vermont 05602
Tel. 802-223-5294

VIRGINIA
Federal Building,
10th Floor
400 N. 8th Street
Richmond, Virginia 23240
Tel. 804-782-2371

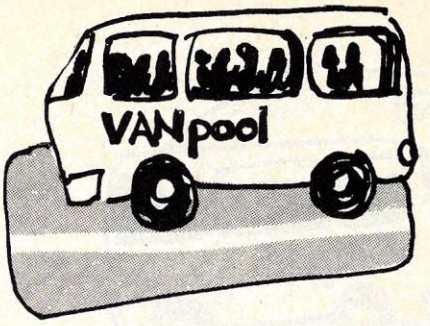
WASHINGTON
Evergreen Plaza Bldg.
Fifth Floor
711 South Capitol Way
Olympia, Washington 98501
Tel. 206-753-9480

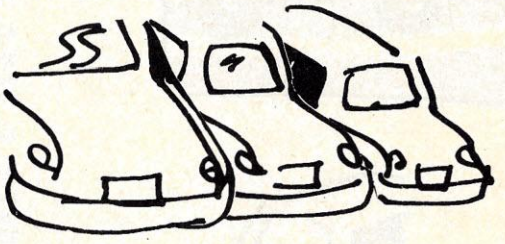
WEST VIRGINIA
Courthouse and
Federal Office Bldg.
500 Quarrier Street
Charleston, West
Virginia 25301
Tel. 304-343-6181

WISCONSIN
4502 Vernon Boulevard
P.O. Box 5428
Madison, Wisconsin 53705
Tel. 608-252-5395

WYOMING
O'Mahoney Federal
Center
2120 Capitol Street
Cheyenne, Wyoming 82001
Tel. 307-778-2220

Update, cont'd . . .





Department of Energy
Washington, D.C. 20585

DEC 05 1979

DEC 4 1979

Honorable Robert J. Lagomarsino
House of Representatives
Washington, D.C. 20515

Dear Mr. Lagomarsino:

This is in response to your letter of November 1, 1979, to Lew Pratsch, enclosing a letter from your constituent, Mr. John Craig, requesting information on starting and funding a carpool matching system for small and medium sized cities.

The Department of Energy (DOE) agrees with Mr. Craig that there is a need for improved carpool matching services. The possibility of using the personal computers for carpool matching in small and medium sized cities is a very innovative and exciting idea since the Nation could possibly utilize this resource on short notice in the event of another gasoline shortage. We encourage the funding and development of a few pilot programs to test the potential of such systems during periods of varying gasoline availability.

Individuals, local nonprofit organizations and institutions, State and local agencies, and small businesses are eligible to apply for grants from DOE's Appropriate Technology Program which is operated on a regional basis. We are also enclosing a flyer on the Appropriate Technology Small Grants Program for your constituent's information. For more information Mr. Craig's readers may contact:

U. S. Department of Energy
Office of Small Scale Technology
Washington, D.C. 20585
(202) 376-4480

DOE is currently providing grant funds to States to implement energy conservation plans under the provisions of Title III of the Energy Policy and Conservation Act of 1975. In order to be eligible for these funds, each plan must include a program to promote carpools, vanpools and public transit. Mr. Craig's readers can contact their respective State Energy Office, usually located in each State capital, for possible funding under this program.

To provide additional information on the state of the art in mini and micro computers for carpools matching Mr. Lew Pratsch of my staff called Mr. Craig November 28, 1979.

If we can be of further assistance, please let us know.

Sincerely,

Paul J. Brown, Acting Director
Transportation Programs
Office of Assistant Secretary
Conservation and Solar Energy

Enclosure

Excerpt from Department of Energy Fact Sheet on Appropriate Technology, Small Grants Program:

Who is Eligible to Apply for Grants?

Individuals, local nonprofit organizations and institutions, state and local agencies, Indian tribes, and small businesses are eligible to apply for grants. Straightforward procedures for grant application have been established to ensure that all applicants receive equal consideration. Applications will be evaluated by people familiar with state, local, and regional requirements and resources to ensure that the projects selected for funding are responsive to local needs and concerns.

Every effort will be made to notify all interested persons of implementation of the program in their regions. Proposals will be solicited through program announcements in the *Commerce Business Daily*, newspapers, and trade and technical publications. Announcements will also be sent to state and local governments and to a variety of associations and groups that have expressed interest in the program to DOE.

Update, cont'd . . .

THE WHITE HOUSE

WASHINGTON

November 19, 1979

Dear Mr. Craig:

Thank you for your recent letter to President Carter with a copy of Creative Computing Magazine. We appreciate you sharing this material with us.

I am sending you material on the President's recent actions on carpooling. You might want to contact some members of the National Task Force on Ridesharing.

Your frustrations about finding out what sources there are for funding sound familiar. It is a problem we often face. I am taking the liberty of bringing your request to the attention of the Department of Energy and hope you will be hearing from them soon.

I wish I was an expert of sufficient background and authority to comment on your article about the use of computers in carpooling, etc., but there's no use in pretending to be what I am not. I can just say you obviously had a good technical presentation and, equally as important, you care. The concept sounds workable and, as the Iranian situation once again has underlined for us all, we must do more to conserve energy.

Again, our thanks.

Sincerely,

Jim Purks

Jim Purks
Assistant Press Secretary
Office of Media Liaison

Following are some of the initiatives announced by President Carter in his delivery on car and van pooling on October 25th, 1979:

EMBARGOED FOR RELEASE ON
DELIVERY OF THE PRESIDENT'S REMARKS OCTOBER 25, 1979

Office of the White House Press Secretary

FACT SHEET

INITIATIVES IN ENERGY CONSERVATION THROUGH RIDESHARING

--Formation of a National Task Force on Ridesharing to encourage business and government leaders across the country to initiate and expand ridesharing programs, and to assist in overcoming regulatory, financial, and other institutional barriers to carpooling and vanpooling.

--Mobilization of special efforts by the USDA Extension Service, the Commerce Department's Economic Development Administration, and the Community Services Administration, to assist isolated low-income residents of rural areas to organize and operate ridesharing programs.

--Making ridesharing an area of increased emphasis within the Department of Transportation, by working for passage of the Auto Use Management Program and targeting a portion of its funds for ridesharing programs and projects; expanding the Cities Ridesharing Demonstration Program; instituting a national ridesharing information clearinghouse; organizing regional conferences to promote ridesharing; and other initiatives.

--Setting a national goal of saving 400,000 barrels of oil per day by 1990 through ridesharing.

--Showcasing innovative efforts to encourage ridesharing which are already in progress in communities.

Hayden Has Openings for Microcomputer Software Specialists

Hayden Book Company in Rochelle Park, N.J. is expanding its software operation immediately and is interviewing for three microcomputer software product managers to assist in the acquisition and development of products in these areas:

Business Applications
Entertainment
(Games and other amusements)
Education (Schools and Universities)

If your interests and experience are appropriate, please send a vita/resume to:

Bill Cook, Editorial Director
Hayden Book Co., Inc.
50 Essex Street
Rochelle Park, N.J. 07662

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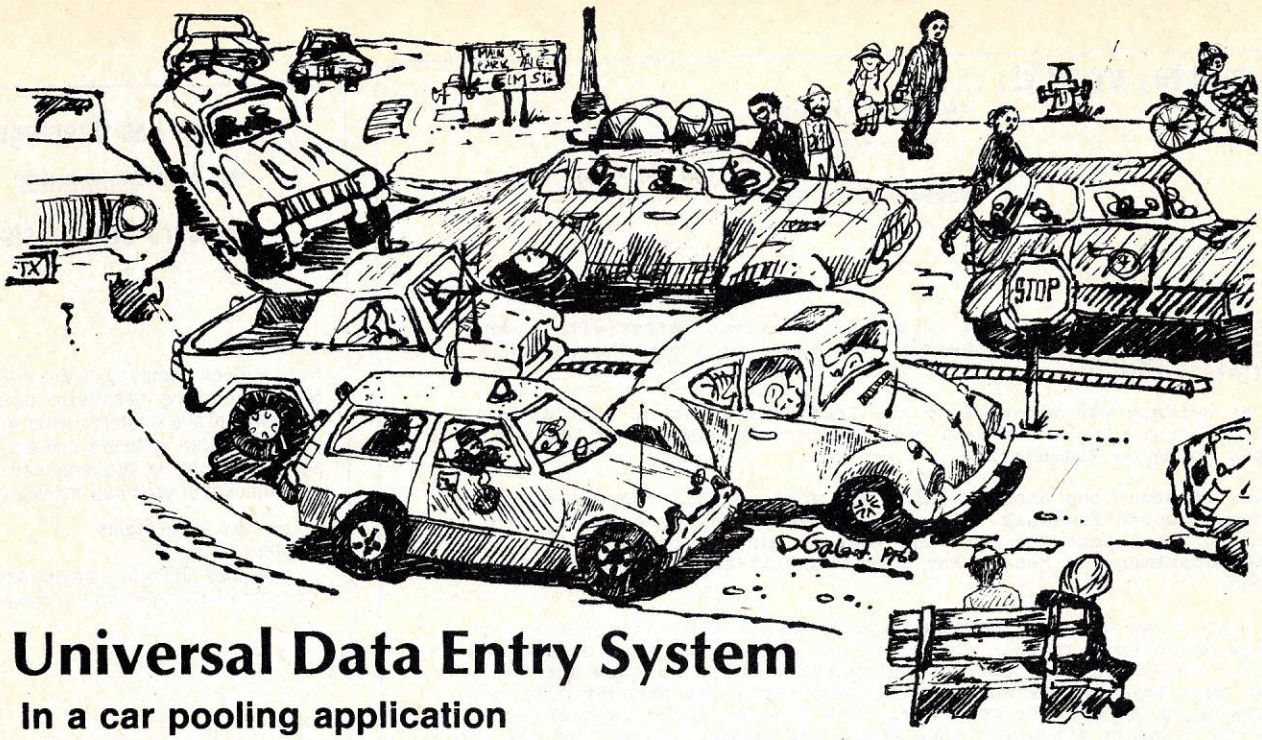


Universal Data Entry System

In a car pooling application

Rich Didday

A review of the Universal Data Entry package from The Software Store as applied to developing a car pool data base system.

See, these two guys are sitting in a bar, downing a few beers. To their right, a disreputable looking man in a seedy wool suit is running a game of three card Monte. To their left, a woman is trying to line up the three bottle caps from amongst the dimes in three moves or less. Behind them a guy has just won $5 betting that he can get a peeled hard boiled egg into a beer bottle without breaking it. So naturally, the talk turns to computers.

"OK, I've got a bet for you."

"What."

"You know that rides and riders data base idea that they're so hot for at Creative Computing?"

"Yeah, sure."

"Ten bucks says I can do it in one hour."

"Go on. I don't wanna take your money. But . . . you're on!"

Of course there's a catch, as in all "sucker" bets. If you have the right tools, even big sounding projects can

Rich Didday, 1218 Broadway, Santa Cruz, CA 95062.

```
  Field          Number of Characters


Last Name.....................17

First Name....................11

Phone Number..................1@

Home or Work Phone?..... 1

Work Starting Hour..... 4

Work Ending Hour..... 4

Days of Week..... 1

Category (Drive, Share, Ride).. 1

Home Map Grid..... 1

Work Map Grid..... 1


Field & Record Separators......11

                                -------

                  62  Total Characters
```

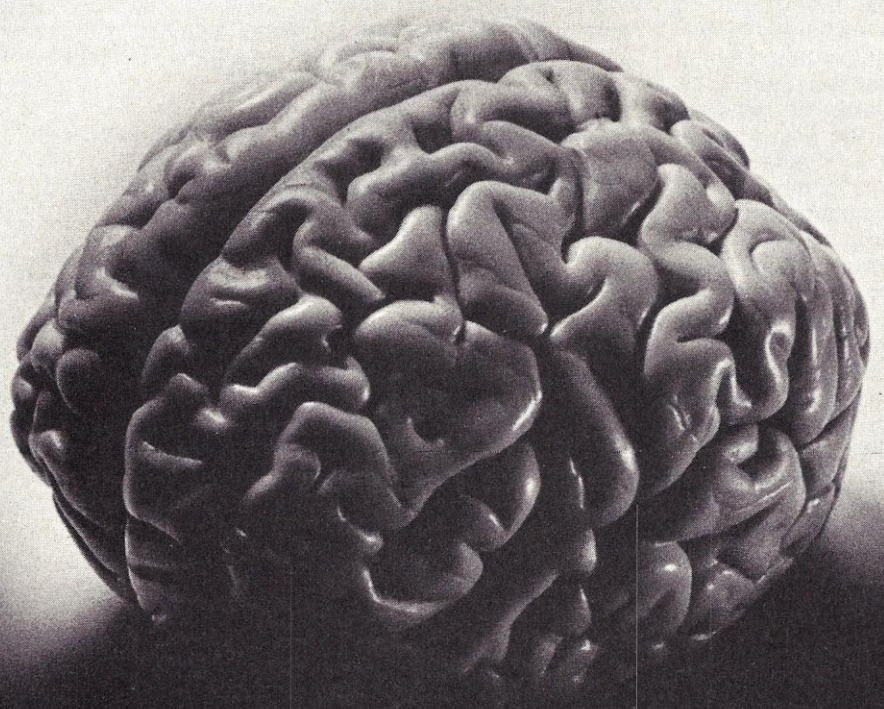
Figure 1.
Suggested record organization for car pool problem. From John Craig's article, "Car Pooling & Personal Computers," Nov, 1979, *Creative Computing.*

```
                    THE SOFTWARE STORE
       >>>>UNIVERSAL DATA ENTRY - MODULE GENERATION<<<<
                          SCREEN #2
DEFINE ALL VARIABLES:

VARIABLE # 4  (<C/F> ENDS VARIABLE ENTRY)
NAME (UP TO 15 CHAR): Home or Work
BATCH TOTAL CALCULATED (<CR>=NO;Y=YES):
AUTO ENTRY/VALIDITY CODE: 7
<CR>=NO AUTO ENTRY/VALIDITY CHECK
   1=AUTO DUPLICATE
   2=FIXED VALUE
   3=FIXED VALUE ENTERED EACH RUN
   4=INCREMENTED FIELD
   5=INCREMENTED FIELD ENTERED EACH RUN
   6=CHECK DIGIT TEST
   7=TABLED VALUE TEST
   8=RANGE TEST

ENTER ALLOWABLE VALUES (<C/F>=END;<C/D>=DELETE):

 ENTRY  ALLOWABLE
   #      VALUE
   1      H
   2      W
   3      ^F


PAGE EDIT: ARE THESE ENTRIES CORRECT (<CR>=YES;N=NO):
```

Figure 2.

Defining the fourth field ("Home or Work Phone?"). The display appears in this order: First the header, then the variable number (4), then the NAME prompt. After you type in the name you want to use for that field, UDEGEN asks if you want a BATCH TOTAL computed (that is if when the finished module is being used, a running sum of the values entered for field 4 should be maintained). Then the next 10 lines appear and the cursor moves back up to the AUTO ENTRY/VALIDITY CODE line to get your selection. Here option 7 was selected, meaning that when the finished module is being used, the value entered must be one of the values listed in a table of legal entries. Next, the legal entries (H and W) are specified. Finally, you have a chance to go back to change any erroneous entries. A similar process is carried out for each field.

THE ULTIMATE INFORMATION MANAGEMENT SYSTEM



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The Standard In Information Management Systems

CIRCLE 159 ON READER SERVICE CARD

Data Entry, cont'd...

be easy. The catch is that the brash bettor is planning on using a set of packages from The Software Store.

To set up a system to implement a rides and riders data base system, you need:

1. A program which accepts records from the user and stores them on a file.

2. A program which massages the file of records to put it in a useful format.

3. Programs which generate reports from the files.

Here's how our barroom big roller planned to win his bet. First, he would use The Software Store's Universal Data Entry Module Generator to quickly produce a program which accepts records from a user and stores them on a sequential file. Step 1, he estimated, would take 10 minutes. Then he would use the Sort Module Generator program to create a program which would take the entered records, sort them by name and then sort them according to map grid coordinates. He estimated that would take another 10 minutes. Finally, he would have to do a little programming on his own to get the two sorted files printed out in a nice format. His idea for using the system was that the two listings would be cut up to produce a cross reference directory that the users could access to match people up for rides. After that, he figured if there was any time left in his hour, he could write a little program that would search for specific home map grid/work map grid pairs — so the system could automatically print out lists for specific people.

Let's follow each of the steps (and software packages) the bettor was planning on using. First, the Data Entry Module Generator.

Defining the Data

The purpose of the UDEGEN program is to produce a program which handles data entry for a specific file format. UDEGEN asks a number of questions about the file, allows you to define a classy looking display with "fill in the blank" spaces for data entry, and if all goes well, leaves you with a program (data entry module) which can be used from then on to enter data. To create a module for the rides and riders data base, first, you need a description of the fields in each record. Figure 1 shows the fields defined in John Craig's article ("Car Pooling and the Personal Computer," *Creative Computing,* Nov, 1979).

The first thing you do in the UDEGEN program is to define the characteristics of each field. Figure 2 shows the questions and answers for the 4th field. The 4th item is a single character (either H or W) which tells if the phone number stored in the 3rd field is a "Home" phone or "Work" phone. Next you define the file characteristics (variable length vs. fixed length, etc.). Finally, you specify in detail the display the users will see when they use the finished module. Figure 3 shows a typical "screen" for the rides and riders problem. To define a screen, you are presented with a numbered grid, and you type exactly what you want exactly where you want it. In this case, there are underlines where values will be entered — to indicate how many characters are expected. After you're satisfied with the screen's appearance, you define where (row and column) each value is to be entered. If all goes well, at this point, UDEGEN writes the finished data entry module to disk, and you're ready to try it out.

Entering & Using the Data

To use a data entry module you've defined using UDEGEN, you run UDE, give the module name and sit back. Soon the CRT clears and fills with an image of the screen you defined. The cursor moves to the place where the first value is to be entered, and as you type, the value overwrites the underlines. When you hit Return, the cursor moves to the next place for data. If you make a typing error, editing commands make it possible to go back to any field and re-enter it. After all fields have been defined, the filled-in record

```
                    THE SOFTWARE STORE
        >>>>UNIVERSAL DATA ENTRY - MODULE GENERATION<<<<
                          CRT FORMAT


PROGRAM MODULE: RDB  OPERATOR: rld  DATE: 10/2/79

  .000000000111111111122222222223333333333444444444455555555556666666666777 7
  .123456789012345678901234567890123456789012345678901234567890123456789012 3
  ..........................................................................
 1.
 2.                              Ride Data Base Record
 3.                              ++++++++++++++++++++
 4.
 5.          Last Name:_____________________          First Name:___________
 6.
 7.          Phone:    __________     Is phone home (H) or work(W)?:_
 8.
 9.          Use the 24 hour clock for work hours, e.g. 11PM=2300
10.          Work Start Hour:____                     Work End Hour:_
11.
12.          Work Days (Coded form):_                 Category (Drive, Share,
13.                                                        or Ride only):_
14.
15.          Home Map Grid:_                          Work Map Grid:_
16.
17.
18.
19.
20.
21.
22.
23.
24.
```

Figure 3.

A printout showing the data entry screen that was defined for this module. The finished module will display an exact copy of this on the CRT. The end user then fills in values for each field. This "screen" was defined simply by typing everything as shown, on the CRT. UDEGEN figures out how to reproduce the screen, and stores that information in the finished data entry module. There is also an "automatic" mode in which UDEGEN chooses a "reasonable" screen for you, using the names you entered when you defined each field.

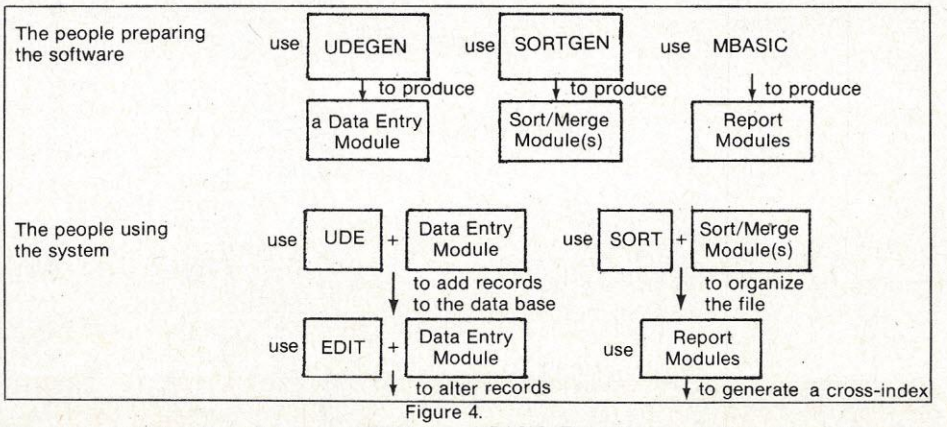
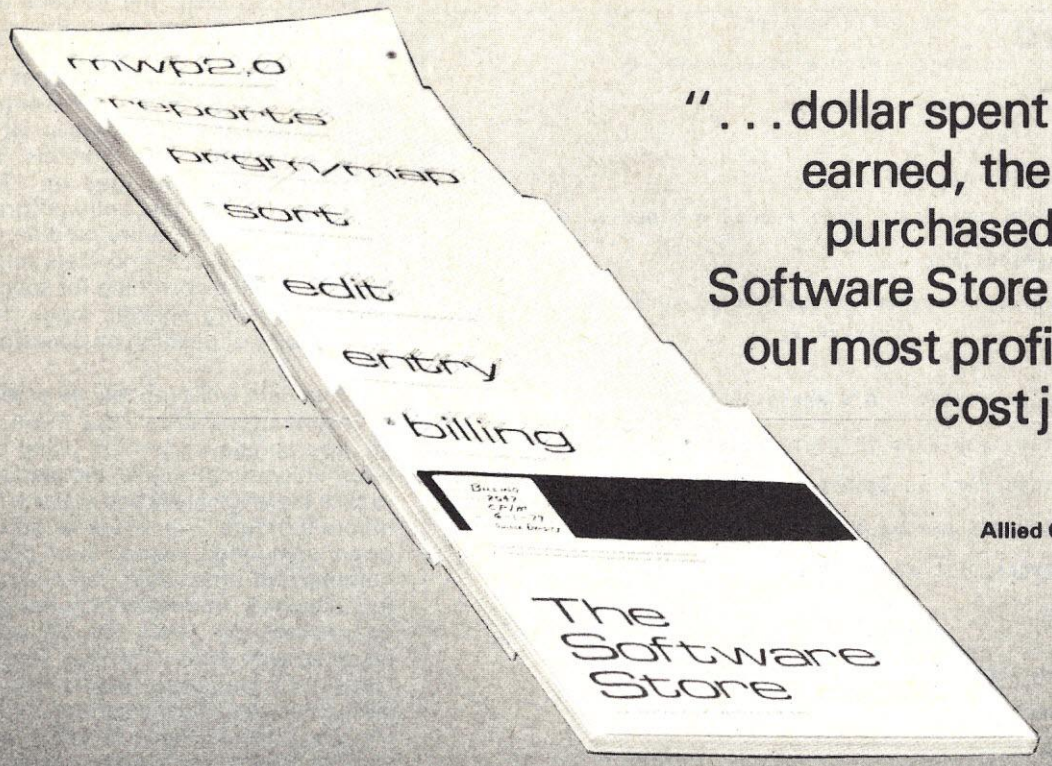


Figure 4.

The people preparing the software use UDEGEN to define a data entry module, SORTGEN to define sort/merge modules, and write report modules in MBASIC. The end users (who need have little or no experience with computers) use the finished modules.



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Why reinvent the wheel? The Software Store supplies complete program systems written in easy to use Microsoft BASIC for Radio Shack Model II, Altair/MITS, TEI, Cromemco, North Star, Processor Tech, Altos, Ohio Scientific, Billings, IMSAI, Digital Micro Systems and other Z80 & 8080 based computers. Our growing family of products is divided into three categories: *application utilities, systems* and *system utilities.*

The *application utilities* are the basic building blocks for application program systems. Almost every application can be made of a key-to-disk data entry segment, a file edit segment, a sort/merge segment, a record selection segment and a report & file update segment. These functions are carried out by the ENTRY, EDIT, SORT, SELECT and REPORTS systems, respectively. Application utilities consist of two programs: one for interactive task definition and the other for task execution. Once defined, a task may be executed any number of times or easily revised.

Application utilities permit rapid solutions to satisfy each user's unique requirements. Many first time computer users have built respectable application systems using our utilities and self instructive documentation. Computer stores and consultants utilize our products to generate custom systems for their clients. Because of the flexible and interactive design of the task definition programs, previously defined systems can be easily revised to meet changing needs.

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The *system utilities* include programming tools such as the Program Map BASIC cross reference program along with general utilities such as the Disk Fix file recovery program, the Disk Copy (1D & 2D) diskette copy program, the TX-RX file transfer and media conversion programs and the CATALOG diskette library index program.

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CIRCLE 210 ON READER SERVICE CARD

Data Entry, cont'd...

```
                    THE SOFTWARE STORE
            >> DISKSORT - MODULE DEVELOPMENT <<

                          SCREEN #1

OPERATOR INITIALS? rld

DATE AS MONTH-DAY-YEAR? 10/3/79

ARE YOU REVISING AN OLD MODULE [ <CR> = OLD  N = NEW ]? N

NEW MODULE NAME? MAPSORT.MDL

FILE NAME: 'MAPSORT.MDL'   DRIVE [ <CR> = A ]? AWORKING ...
                          SCREEN #2

 OPERATION TYPE [ <CR> = SORT   M = MERGE ]? SORT

 NAME OF THE FILE THAT YOU WISH TO SORT? RIDES.DAT

 DRIVE ON WHICH 'RIDES.DAT' IS STORED [ <CR> = A ]? A

 SORTED OUTPUT FILE NAME? MAPORD.DAT

 DRIVE ON WHICH 'MAPORD.DAT' IS TO BE STORED [ <CR> = A ]? A
                          SCREEN #3

 NUMBER OF FIELDS IN EACH RECORD? 10

 NUMBER OF HEADER RECORDS IN SORT FILE [ <CR> =  0 ]? 1

 INPUT FORMAT [ <CR> = RECORDS  F = FIELDS ]? RECORDS
                          SCREEN #4

 NUMBER OF FIELDS ON WHICH TO SORT [ <CR> =  1 ]? 2

 MAJOR SORT FIELD#? 9

 FIELD TYPE [ <CR> = CHARACTER  N = NUMERIC ]? C

 ASCENDING OR DESCENDING [ <CR> = LO->HI  D = HI->LO ]? A

 NEXT SORT FIELD#? 10

 FIELD TYPE [ <CR> = CHARACTER  N = NUMERIC ]? C

 ASCENDING OR DESCENDING [ <CR> = LO->HI  D = HI->LO ]? A
                        SCREEN #5
                   SORT MODULE SUMMARY
File Header  FILE NAME: MAPSORT.MDL   DATE : 10/3/79   OPERATOR : rld

 Operation Type  SORT

 Name of file to sort  RIDES.DAT     Drive  A

 Fields / Record  10     Header records  1     Input format  RECORD

 Output file name  MAPORD.DAT   Drive  A   Number of key fields  2

 Field     Type      Sequence     Priority
   9       CHARACTER     LO->HI          1
  10       CHARACTER     LO->HI          2

ARE YOU READY TO WRITE SORT MODULE 'MAPSORT.MDL' [ <CR> = NO Y = YES ]? Y

DO YOU WANT TO RUN THIS MODULE [ <CR> = NO   Y = YES ]?
                                                    WORKING ...
SORTGEN - NORMAL END OF JOB

Ok
```

Figure 5.

The sequence of events involved in defining a sort module to order the file on home and work map grid values. Screen 1 gets the operator name, date, and desired name of the finished module. Screen 2 determines the operation (Sort), source file, and desired name of output file. Screen 4 gets the details of the sorting operation. Here we want to sort on two fields, field 9 (home map grid) and field 10 (work map grid). That way, within groups with the same home map grid, the work map grids will be in alphabetic order. Similarly, in the sort on names (not shown), the major sort field was Last Name, and the secondary sort field was First Name. Screen 5 gives a summary of the sort module that was defined.

is written to disk, the current data values disappear, and you're ready to enter the next record.

Of course over time, changes will have to be made to some of the entries in the data base, and there must be some way to fix them. For this, The Software Store provides an EDIT program. Like the data entry program, EDIT uses the data entry module you defined for the file, but now lets you go through the file, searching for specific records, altering specific fields, perhaps adding or deleting an occasional record.

The data will probably be entered in chronological order. But that's not an appropriate order for using the information. In this case, the plan was to take the original file and sort it in two different orders. First by name, so that given someone's name, their phone number and other data items can be found quickly. And second by map grid coordinates, so riders can be easily matched with rides. The Sort Module Generator package allows you to define the input file, the sorting (and/or merging) operations to be performed, and the output file. Figure 5 shows the entries required to define the sort on home and work map grids. Figures 6, 7, and 8 show some sample data — as entered, as sorted by name, and as sorted by map coordinates.

So far, so good. By using the modules sold by The Software Store, you can define elaborate data entry modules, perform data entry to your file, edit the records, and sort (and merge) data files with amazing ease. Next the plan was to write programs to print the ordered data in appropriate formats so it could be used efficiently by people.

Programs to Format & Print Data

Since the bettor wanted to do everything in an hour, he didn't plan very elaborate programs to display the data. He wanted one program which would print all the information in each record in an easy to read form. Figure 9 shows a sample of the desired format, and Figure 10 shows the MicroSoft Basic program he came up with to produce the listings. The last part of his plan called for a program which would print a list of items which could quickly be used to find the names of likely match-ups for a person with a given home/work map grid pair. Figure 11 shows a sample of what he had in mind, and Figure 12 shows the program he wrote.

How Good Is the Package?

Now that we've seen how our friend used The Software Store packages, let's pause and look at the good and bad points of the packages themselves.

Data Entry, cont'd...

The hardware you need to use these packages includes an 8080 (or Z80 or 8085) based machine with at least 48K of memory, CRT, printer, and at least one disk drive. The packages are written in Microsoft Extended Disk Basic, and are available in versions for both MITS/Pertec systems and systems that use the CP/M operating system.

Installing the packages takes a bit of work. It's not too bad, but you need some knowledge of Microsoft Basic and the details of your system. Since the machine I used to make these tests has an uncommon CRT controller, I had to change the definitions of the CRT control codes in each package. In the UDEGEN, UDE, and EDIT packages, the Basic statements which define the control codes (like "move cursor up," "clear screen," "home cursor," etc.) appear in program lines 150-260. For those three programs, it suffices to write a little program with the proper definitions, and then merge it with each package. But the control code definitions are not in the same places in the SORTGEN program, so you have to go through and find them by hand. Even though the sales literature says that the packages will run under Microsoft Basic version 4.4 or later, and even though I was using version 4.45 for these tests, I had to make other changes. Every package makes use of a function call which doesn't exist in 4.45. After looking at the statements around the places the errors occurred, I deducted that INPUT$(1) is supposed to return a single character from the keyboard. I wrote a little subroutine that PEEKs and POKEs the next character from the keyboard, and revised the statements which included INPUT$(1). [The INPUT$() statement is available in Microsoft Basic, Version 5.03. — ed.]

Since I was still getting an occasional error message (I was fixing each INPUT$(1) when the program came to it) when I was first learning to use the packages, my estimates of the ease of learning may be a little biased. Be that as it may, and although now that I know how to use them I think they're really good, I found the system moderately difficult to learn to use. The documentation lacks a clear statement of the Big Picture. Instead, the documentation consists of examples of running each package, with little comments at each point that are supposed to enlighten you about what's going on. The first few times through, things were a little mystifying. For example, in the data entry module generator program (UDEGEN), you are asked to answer the question

NUMBER OF VALUES TO BE DISPLAYED PER TRANSACTION ON THE CRT: —

and a little later,

TOTAL NUMBER OF DIFFERENT VALUES INPUT/OUTPUT PER TRANSACTION: —

What makes these a little peculiar is that the comments in the documentation are virtually identical for each, saying "This should include all values manually entered plus all values automatically generated. This entry can be larger than the actual number." The first time through, this is really puzzling. You won't discover what an "automatically generated" value is until the next page (it's a value which is automatically filled in on the screen during the actual data entry process). You can't tell what the difference between the two desired entries are, and you can't even tell if it makes any difference ("This entry can be larger than the actual number."). And when you're trying to learn the system, since you lack the Big Picture, you're not even sure when a comment is referring to a value you're supposed to enter in the module generation phase or to a value that a user will enter in response to the finished module when it's being used in the future. On the other hand, the basic construction of the packages is reasonable, so in a day or two of

```
0000'FILE NAME: RIDES.DAT  UDE: 10/2/79  BY: rld
Smathers,John,427-3499,H,800,1600,G,D,A,C
Teinhoffer,Louise,555-4747,W,0900,630,B,S,D,G
Kinstler,Margaret,439-6600,W,0745,1600,R,S,D,C
Arnoldson,Jason,668-1816,H,0830,1700,D,R,G,A
Samuelson,Kevin,540-1398,H,0700,1500,D,R,G,C
De Bartolome,Bob,831-5633,W,0900,1700,D,S,A,G
Daniels,Sandra,624-9844,W,0900,1700,D,S,C,A
Devlin,Anthony,456-9970,W,1000,1730,F,S,C,G
Deal,Newsom,429-3455,H,800,530,F,R,G,A
Kinstler,James,429-1882,H,0600,1400,R,S,D,C
DeJulio,Gus,468-8800,W,0630,1445,D,S,G,A
Smith,Evangeline,423-1277,H,0800,1500,D,S,G,C
Smithe,Becky Jo,429-8554,H,0830,1700,E,R,C,E
Smithson,Herman,429-5466,W,0830,1630,F,S,A,G
```

Figure 6.
The data base after 14 sample records were entered. UDE automatically adds a header record which it uses to help insure that the next time the data entry module is run, new records are added to the right file.

```
0000'FILE NAME: RIDES.DAT  UDE: 10/2/79  BY: rld
Arnoldson,Jason,668-1816,H,0830,1700,D,R,G,A
Daniels,Sandra,624-9844,W,0900,1700,D,S,C,A
De Bartolome,Bob,831-5633,W,0900,1700,D,S,A,G
DeJulio,Gus,468-8800,W,0630,1445,D,S,G,A
Deal,Newsom,429-3455,H,800,530,F,R,G,A
Devlin,Anthony,456-9970,W,1000,1730,F,S,C,G
Kinstler,James,429-1882,H,0600,1400,R,S,D,C
Kinstler,Margaret,439-6600,W,0745,1600,R,S,D,C
Samuelson,Kevin,540-1398,H,0700,1500,D,R,G,C
Smathers,John,427-3499,H,800,1600,G,D,A,C
Smith,Evangeline,423-1277,H,0800,1500,D,S,G,C
Smithe,Becky Jo,429-8554,H,0830,1700,E,R,C,E
Smithson,Herman,429-5466,W,0830,1630,F,S,A,G
Teinhoffer,Louise,555-4747,W,0900,630,B,S,D,G
```

Figure 7.
The file produced by sorting on Last Name and First Name.

```
0000'FILE NAME: RIDES.DAT  UDE: 10/2/79  BY: rld
Smathers,John,427-3499,H,800,1600,G,D,A,C
De Bartolome,Bob,831-5633,W,0900,1700,D,S,A,G
Smithson,Herman,429-5466,W,0830,1630,F,S,A,G
Daniels,Sandra,624-9844,W,0900,1700,D,S,C,A
Smithe,Becky Jo,429-8554,H,0830,1700,E,R,C,E
Devlin,Anthony,456-9970,W,1000,1730,F,S,C,G
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Arnoldson,Jason,668-1816,H,0830,1700,D,R,G,A
Smith,Evangeline,423-1277,H,0800,1500,D,S,G,C
Samuelson,Kevin,540-1398,H,0700,1500,D,R,G,C
```

Figure 8.
The file produced by the sort module shown being defined in Figure 5. Notice that the records are in order of home map grid (field 9) and work map grid (field 10).

Data Entry, cont'd...

playing around, you can figure out what is going on, and what you're supposed to do. After you've reached that phase, you can deduce that the reason the answers might be different to the two questions is that you might want the data entry module to automatically generate some values (say, a record number, or indexing information), and write them on the disk file, but not burden the user by displaying them on the screen.

Once you know how to use UDEGEN and SORTGEN, they're great. You really can sit down with a list describing a file organization and produce data entry programs and sort/merge programs for that specific file in a few minutes. The data entry program that UDEGEN produces is classy, convenient, and fast. A couple of years ago, I wrote a large, multi file system for a local small business, and I'm not kidding when I say that if I'd had UDEGEN to use back then, I could have done the data entry parts of the system in a day instead of a month. The EDIT program provides a convenient way to alter existing records (and upon user request, it will provide a printed "audit trail" of the changes made). The SORTGEN program makes it very easy to create programs for reordering the information. I won't comment on the speed of the sorting algorithms that the resulting modules use since The Software Store says that their latest versions run substantially faster than the one I tested.

```
Arnoldson, Jason                Category:Ride only
Home Phone: 668-1816
Home Map Grid:G                 Work Map Grid:A
Work Start Hour:0830            Work End Hour:1700
Work Days:D


Daniels, Sandra                 Category:Share
Work Phone: 624-9844
Home Map Grid:C                 Work Map Grid:A
Work Start Hour:0900            Work End Hour:1700
Work Days:D


De Bartolome, Bob               Category:Share
Work Phone: 831-5633
Home Map Grid:A                 Work Map Grid:G
Work Start Hour:0900            Work End Hour:1700
Work Days:D


DeJulio, Gus                    Category:Share
Work Phone: 468-8800
Home Map Grid:G                 Work Map Grid:A
Work Start Hour:0630            Work End Hour:1445
Work Days:D


Deal, Newsom                    Category:Ride only
Home Phone: 429-3455
Home Map Grid:G                 Work Map Grid:A
Work Start Hour:0800            Work End Hour:0530
Work Days:F


Devlin, Anthony                 Category:Share
Work Phone: 456-9970
Home Map Grid:C                 Work Map Grid:G
Work Start Hour:1000            Work End Hour:1730
Work Days:F


Kinstler, James                 Category:Share
Home Phone: 429-1882
Home Map Grid:D                 Work Map Grid:C
Work Start Hour:0600            Work End Hour:1400
Work Days:R


Kinstler, Margaret              Category:S
Work Phone: 439-6600
Home Map Grid:D                 W
Work Start Hour:0745
Work Days:R


Samuelson, Kevin
Home Phone: 540-
Home Map Gri
Work St
```

Figure 9.
The desired format for the directory in order of names. The bettor's plan was to cut the individual records apart and put them in a card file.

One question you may be asking yourself is "How general is it?" It's a law of nature that you don't get something for nothing. It seems clear that there's a trade-off between ease of use and generality in canned software. These packages are fantastic when you're dealing with sequential files that are small enough to fit on one diskette. As you can see by looking back at Figure 2, the data entry module that's created has the ability to keep a total of values entered in each numeric field in a given session (BATCH TOTAL question) and to make a number of validity checks on individual values. Option 6 causes a (specific type of) check digit test to be made. Option 7 allows you to enter a table of legal values (that's the option illustrated in Figure 2). Option 8 allows the module definer to specify a number of numeric ranges within which legal entries must lie. When the finished module is actually being used for data entry, if the operator enters an invalid value, a warning is given, and the operator may choose to override the legitimacy test, re-enter a new value for that field, or delete the entire record. One option that is missing is the ability to test the length of character values the operator enters.

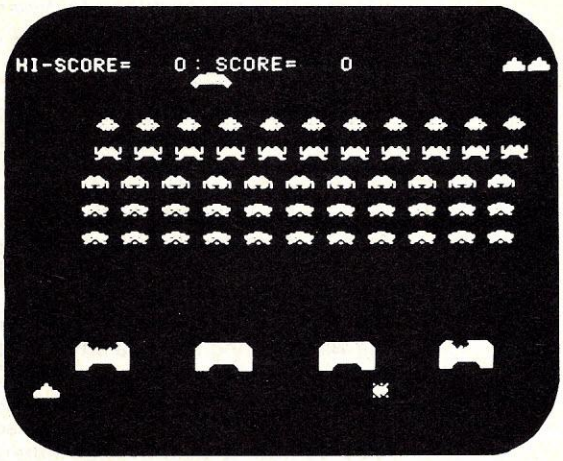
Later in the UDEGEN program, you choose whether the records in the sequential file that will be filled are to be variable or fixed length, separated by field or just record, and you may choose the order in which entered values are to be sent to disk. If you choose the fixed length option, you must give an MBasic PRINT USING format string to define the exact structure of the record.

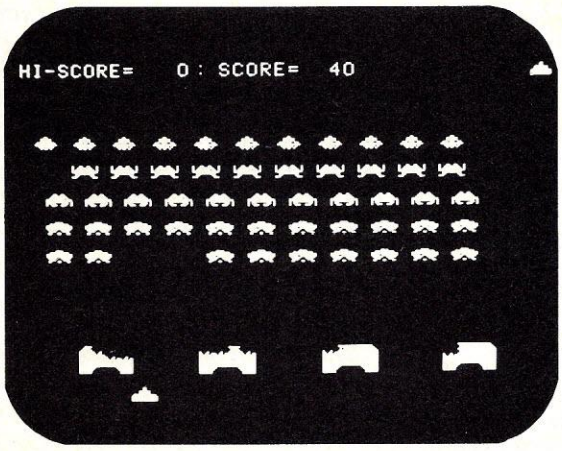
By referring back to Figure 5 you can see the range of options available in the SORTGEN package. One feature that's lacking is the ability to order files on alphanumeric keys without regard to upper or lower case. Look closely at the list in Figure 7 and you'll see why you want to be able to do this in some cases. When upper and lower case letters "count" the same, "Deal" comes before "De Bartolome" and "DeJulio," not after.

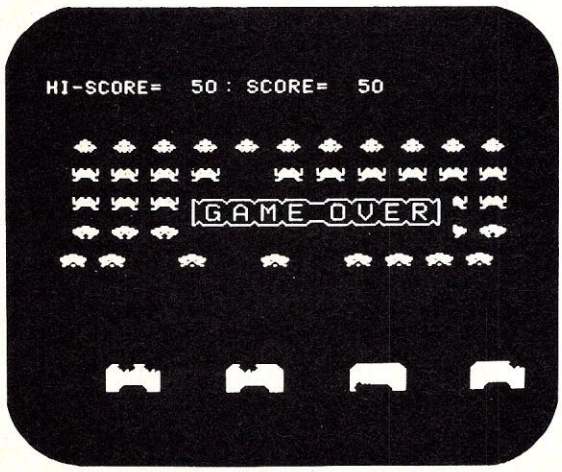
The packages are set up to create, edit, sort, and merge sequential files. But what if you don't have the luxury of using sequential access? What if in your application, you have to be able to get to a specific record in a few seconds? In that case, you'll use random access files, with some sort of indexing scheme. Will you still be able to use The Software Store's packages? It depends. One halfway step to an elaborate indexing scheme would be to use the UDEGEN and UDE pack-

APPLE INVADER

THE GAME DROVE JAPAN CRAZY







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CIRCLE 181 ON READER SERVICE CARD

```
100 REM  LIST NAME ORDERED FILE FOR NAME DIRECTORY.
110 REM  OPEN FILE AND SKIP HEADER RECORD.
120      OPEN "I", #1, "A:NAMEORD.DAT"
130      LINE INPUT #1, R$
140 REM  NOW GO THROUGH ENTIRE FILE, PRINTING EACH RECORD.
150      IF EOF(1) THEN 1000
160        INPUT #1, L$, F$, P$, HW$, H1, H2, D$, C$, MH$, MW$
170        LPRINT
180        LPRINT L$; ", "; F$; TAB(32); "Category:";
190        IF C$="D" THEN LPRINT "Drive only"
200        IF C$="S" THEN LPRINT "Share"
210        IF C$="R" THEN LPRINT "Ride only"
220        IF HW$="H" THEN LPRINT "Home ";
230        IF HW$="W" THEN LPRINT "Work ";
240        LPRINT "Phone: ";P$
250        LPRINT "Home Map Grid:";MH$;TAB(32);"Work Map Grid:";MW$
260 REM    PUT HOURS IN STANDARD 24 HOUR CLOCK FORM (I.E. FORCE
270 REM    FORCE ANY NECESSARY LEADING ZEROS>
280        H$ = STR$(H1)
290        H$ = RIGHT$("0000" + RIGHT$(H$, LEN(H$)-1), 4)
300        LPRINT  "Work Start Hour:";H$; TAB(32)
310        H$ = STR$(H2)
320        H$ = RIGHT$("0000" + RIGHT$(H$, LEN(H$)-1), 4)
330        LPRINT "Work End Hour:"; H$
340        LPRINT "Work Days:"; D$
350        LPRINT
360        GOTO 150
1000 REM DONE.
1010     CLOSE 1
1020     PRINT "Done listing rider directory."
1030     END
```

Figure 10.
The MBASIC program which produces the name directory (Figure 9) from the sorted file (Figure 7).

```
C     G
Home  Work  G

D     C     Map
Home  Work  Grids
                  Kinstle

D     C     Map     Category: Share
Home  Work  Grids
                  Kinstler, James

D     G     Map     Category: Share
Home  Work  Grids
                  Teinhoffer, Louise

G     A     Map     Category: Ride only
Home  Work  Grids
                  Deal, Newsom

G     A     Map     Category: Share
Home  Work  Grids
                  DeJulio, Gus

G     A     Map     Category: Ride only
Home  Work  Grids
                  Arnoldson, Jason

G     C     Map     Category: Share
Home  Work  Grids
                  Smith, Evangeline

G     C     Map     Category: Ride only
Home  Work  Grids
                  Samuelson, Kevin
```

Figure 11.
The desired format for looking up people given a desired home map grid, work map grid, and category.

ages to enter fixed length records, use SORTGEN and SORT to order them, then write your own accessing program which does a binary search on the ordered file. Every time you add or delete a new record, you'll have to make sure the file is left in order (either be very careful when using EDIT, or sort the file again).

To go all the way, you'd have to modify the UDE program so that instead of just tacking new records to the end of the file, it sent them to your own "data base management" routines. One big advantage of having the source code is that you do have the ability to tailor the packages to your specific needs. A table showing each MBasic variable's meaning is provided in the documentation, which is a big help when you're modifying the packages.

Summary

If your needs are for a quick, reasonable way to generate data base entry and sorting programs time after time, and if the file organization you want to use is close enough to that implemented by these packages, they are a tremendous deal. If you want to write a file maintenance system once, or if you absolutely have to have a complex file organization, you'll probably want to do all the work yourself.

And that's that. What? The bet? Oh, the bet. Well, you know how that came out. He made a typing error when he was defining the data entry module, and when he re-ran the UDEGEN program to correct it, he made another that he didn't catch for a while, so he had to run it again. Then when he thought he'd finished defining the sort modules, he got a DISK WRITE ERROR from the operating system, so he pulled the disk out and looked at it, didn't see anything physically wrong, stuck it back in and got a BAD SECTOR error. So he started from scratch on a new diskette. Then when he went to write the programs to print the sorted data, he kept making little "dumb" mistakes. But really, seven hours is pretty impressive for a collection of programs that do this much, isn't it? □

Prices as of summer, 1979

Universal Data Entry Key-to-disk System (UDE and UDEGEN programs)	$195
Manual only	$ 15
Universal Data Entry Edit System (EDIT)	$ 95
Manual only	$ 10
Disk Sort System	$195
Manual only	$ 15

from: The Software Store
706 Chippewa Square
Marquette, MI 49855

```
100 REM  LIST MAP GRID ORDERED FILE FOR RIDES DIRECTORY.
110 REM  OPEN FILE AND SKIP HEADER RECORD.
120      OPEN "I", #1, "A:MAPORD.DAT"
130      LINE INPUT #1, R$
140 REM  NOW GO THROUGH ENTIRE FILE, PRINTING EACH RECORD.
150      IF EOF(1) THEN 1000
160        INPUT #1, L$, F$, P$, HW$, H1, H2, D$, C$, MH$, MW$
170        LPRINT
180        LPRINT MH$; TAB(6); MW$; TAB(12); "Map"; TAB(22); "Category: ";
190        IF C$="D" THEN LPRINT "Drive only"
200        IF C$="S" THEN LPRINT "Share"
210        IF C$="R" THEN LPRINT "Ride only"
220        LPRINT "Home"; TAB(6); "Work"; TAB(12); "Grids"
230        LPRINT TAB(22);L$;", ";F$
240        LPRINT
250        GOTO 150
1000 REM DONE.
1010     CLOSE 1
1020     PRINT "Done listing rider directory."
1030     END
```

Figure 12.
The MBASIC program which produces the location directory (Figure 11) from the sorted file (Figure 8).

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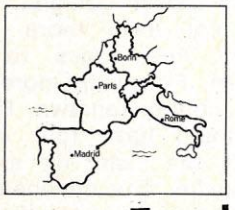

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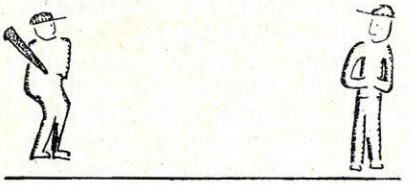

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The 80 page reference manual describes all the features. These include the macro facility, assembly directly into memory, condtional assembly, the additonal expression evaluators, automatic origin, alphabetic symbol table and the quash command. Additional editor commands and the new debugger are also fully explained.

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Disk based system to be announced.

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from Small System Software

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Computer-Aided Model Rocketry Design

Keith N. Schlarb

Clubs, individuals and science teachers interested in designing model rockets can now use a personal computer system to aid in perfecting those designs.

Model rocketry generates high interest and motivation, and thus has been the perfect activity for my eighth grade science classes. Model rockets lend themselves to the application of many concepts taught in science classes, such as acceleration, velocity, gravity and drag. Interest in these concepts is stimulated through rocket building. I used the project principally as a high interest unit for measurement. For this reason each student built a kit and was required to design and build a flying model. It was through the design process, which required drawing and accurate measuring, that the objectives of the unit were met.

Before students started their design, the idea of stable flight was discussed. Having already launched the rockets built from kits, the students had observed some excellent examples of unstable flight. It was determined that the stability of their rocket design should be considered before actual building. It was explained that by finding the center of gravity, the balancing point of the rocket's weight, and the center of pressure, the balancing point of all air pressure forces of the flying rocket, they could, in fact, determine the stability of their design.

The center of gravity was easily found, but to calculate the center of pressure, extensive math computation and graph reading, from the **Technical Information Report-33 Calculating the Center of Pressure**, were required. It was necessary to determine the center of pressure of each region of the rocket separately; nose, fins, conical shoulders and boattails. The student would then combine these to compute the overall center of pressure. Although the mathematics were not complicated, the number of steps became confusing to the students and made finding the center of pressure extremely difficult.

The following procedures and computer program for determining the center of pressure were written to alleviate this problem and should prove useful for others designing model rockets for science classes, clubs, or as a hobby. The computer program was written on a TRS-80, 16K, Level II, but 4K should be sufficient if the REM statements are removed and multiple statements instituted. The bracket [indicates exponentiation, which may be entered as ↑ with Level II. The assumptions and calculations for the center of pressure program are from the **Technical Information Report-33 Calculating the Center of Pressure of a Model Rocket.** I suggest anyone interested in a more detailed explanation of flight and the center of pressure consider purchasing the report.

Steps To Designing A Model Rocket

STEP 1. Make a full scale drawing of your design including lengths of all required measurements to the nearest tenth of an inch. Figure 1 shows the required variable measurements of two rocket designs. Your fins must not have more than four straight line edges to use the program. Fins with more than four edges must be redrawn. The redrawn fin should have four edges and contain the same fin area as the original fin. The dimensions of the redrawn fin are used to determine the center of pressure. If the design is stable with the redrawn fin, it should be stable with the original fin design. See Figure 2 for examples of redrawn fins. The number of fins can only be 3, 4, or 6. Your design may be multiple staged, in which case you must calculate the stability of each stage separately. The design may include up to two conical boattails and two conical shoulders.

Keith Schlarb, 5617 Indianolia Ave., Worthington, OH 43085.

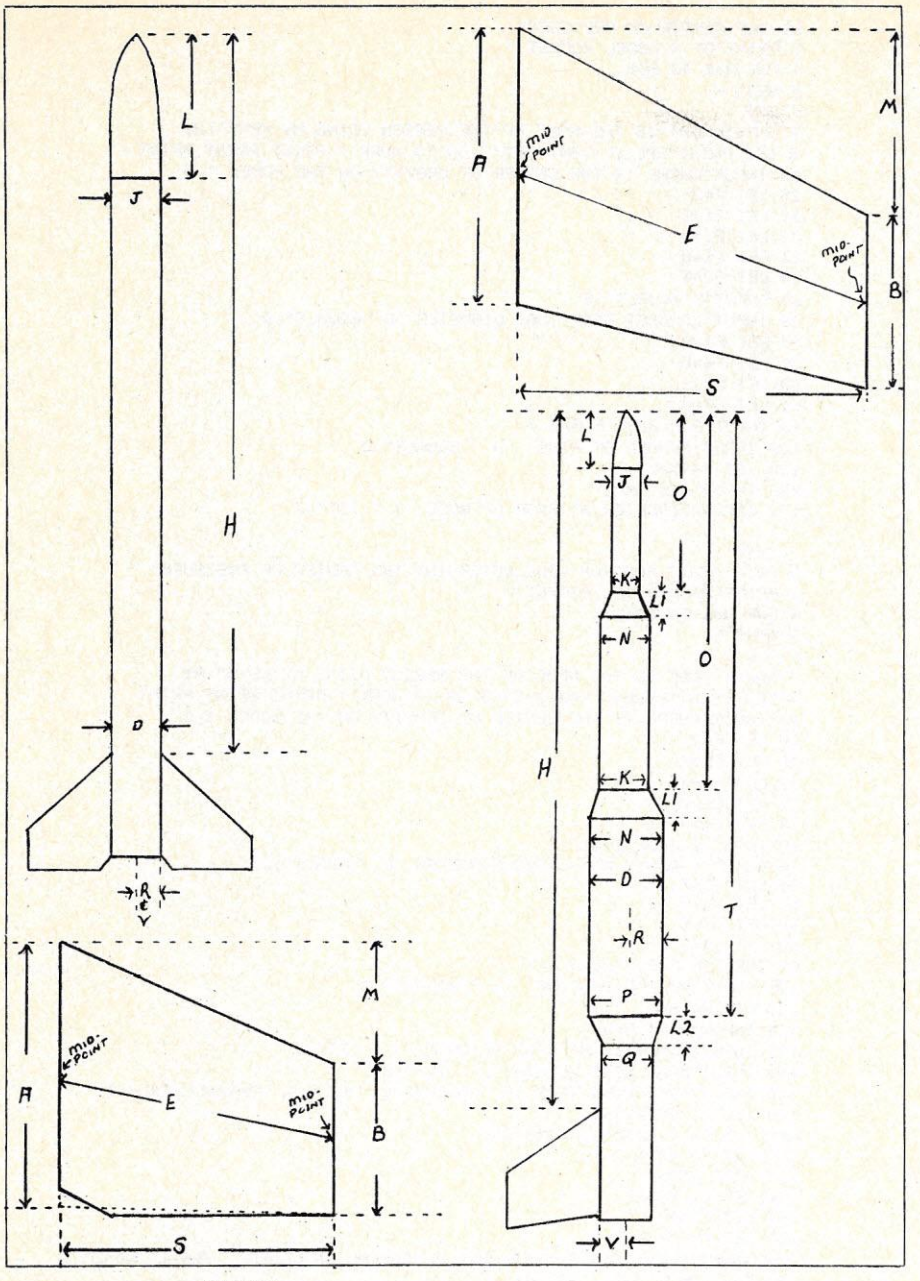

Figure 1.
Shown are the variable measurement locations.

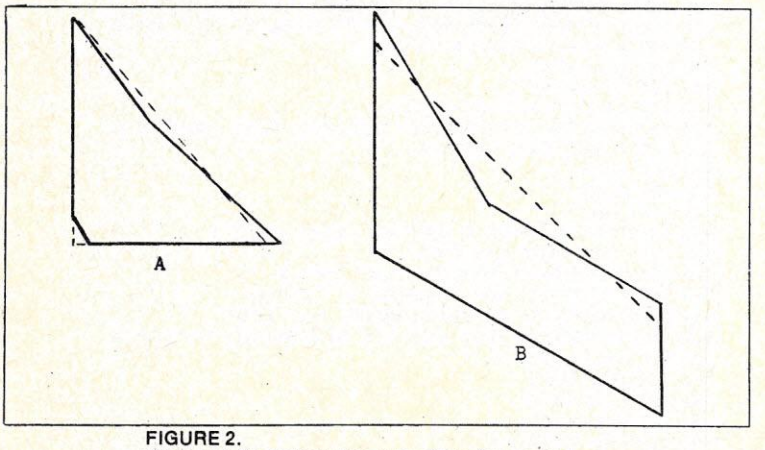

FIGURE 2.
When the fin design has more than four edges it must be redrawn to use the program. The redrawn fin should have the same surface area as the original. Note that in fin A the variable B = 0.

STEP 2. Secure the required parts of your model and build the entire design with the exception of the fins.
STEP 3. When the glue is dry, place the recovery device, wadding and a new engine, the size you plan to use for flight, in the model. Using a length of string make a loop through which the body tube can be placed. Move the model back-and-forth until the balancing point is found (see Figure 3). This balancing point is the center of gravity. Mark the center of gravity. This balancing technique is accurate if:

"(1)The overall length of the body is greater than twelve times its largest diameter" or,

"(2)The design has more than one engine (two or three stages or clusters)" or,

"(3)The design has a payload that weighs at least as much as an engine."

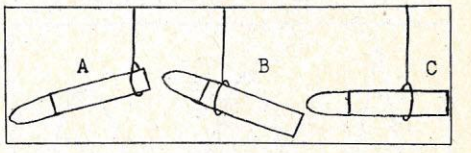

FIGURE 3. Finding the center of gravity. The rocket weight is not balanced in A or B but in C the weight is evenly distributed. Mark the location on the body tube; this balancing point is the center of gravity.

VALUE	VARIABLE	
_____	G = Center of Gravity	
_____	S = Length of S on fin	
_____	D = Largest body tube diameter	
_____	E = Length of E of fin	
_____	A = Length of A of fin	
_____	B = Length of B of fin	
_____	V = Radius of body tube between fins	
_____	U = Number of fins	
_____	M = Length of M of fin	
_____	H = Distance from nose tip to top of fins	
_____	J = Diameter at nose base	
_____	L = Nose cone length	
_____	Nose cone type	
	Conical shoulder 1	**Conical shoulder 2 values**
_____	L1 = Length of shoulder	_____
_____	K = Top diameter of shoulder	_____
_____	N = Bottom diameter of shoulder	_____
_____	O = Distance from nose tip to shoulder top	_____
	Conical boattail 2	**Conical boattail 2 values**
_____	L2 = Length of boattail	_____
_____	P = Top diameter of boattail	_____
_____	Q = Bottom diameter of boattail	_____
_____	T = Distance from nose tip to boattail top	_____

FIGURE 4.

Rocketry, cont'd...

STEP 4. Find the center of gravity distance, G, by measuring the distance from the nose cone tip to the balancing point.

STEP 5. Make a list of the measurements of all variables you have. Figure 4 gives a list of all values you will need to use the program. If your design does not have a boattail or shoulder there will be no values for those. Determine the nose cone type by comparing with those of Figure 5.

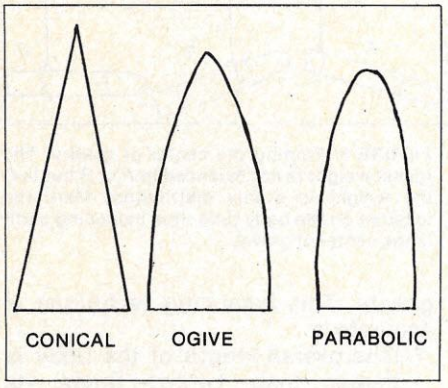

FIGURE 5. Nose cone types.

STEP 6. Determine the stability of your model using the center of pressure program. A stable rocket means it is able to correct small variations in its flight to maintain a vertical flight path. A rocket is determined to be stable if the center of pressure is at least one body tube diameter behind the center of gravity. If the model is overly stable, its flight path will bend into the wind (if there is a breeze during flight), rather than continue in vertical flight. The program considers the distance of twice the body tube diameter behind the center of gravity to be overly stable. This factor could be changed, if desired, in Line 850.

STEP 7. If your design is stable, cut out the fins and complete building. If it is unstable, you may add weight to the nose and recalculate the center of gravity (Step 3). Then run the program to test for the center of pressure and stability. You could also enlarge the fin area by increasing your fin area and again calculate the center of pressure and stability.

STEP 8. Complete building and launch.

Information required for this article and program was made available through the courtesy of the Centuri Engineering Company, Box 1988 Phoenix, AZ 85001, publisher of **Technical Information Report-33 Calculating the Center of Pressure of a Model Rocket.** □

```
NE THE CENTER OF PRESSURE"
3 PRINT"OF A MODEL ROCKET. "
4 FOR H=1 TO 800
5 NEXT H
6 CLS
7 INPUT"WHAT IS THE NAME OF THE PERSON USING MY KEYS";A$
8 CLS:PRINT"HELLO ";A$,"LET'S GO TO WORK. ":PRINT:PRINT:PRINT
14 INPUT"WHERE IS THE CENTER OF GRAVITY ON THE MODEL ";G
20 LET F=2
21 LET F1=0
22 LET F2=0
23 LET C1=0
24 LET C2=0
29 INPUT"S EQUALS";S
39 INPUT"LARGEST BODY TUBE DIAMETER 'D' EQUALS";D
50 LET F3=0
51 LET F4=0
60 LET C3=0
61 LET C4=0
69 INPUT"E,A,B,V";E,A,B,V
109 INPUT"NUMBER OF FINS  'U ' EQUALS";U
130 LET R=.5*D
139 INPUT"M,H";M,H
152 INPUT"DIAMETER AT BASE OF NOSE 'J ' IS?";J

1 CLS
2 PRINT"THIS PROGRAM WILL DETERMINE THE CENTER OF PRESSURE"
3 PRINT"OF A MODEL ROCKET. "
4 FOR H=1 TO 800
5 NEXT H
6 CLS
7 INPUT"WHAT IS THE NAME OF THE PERSON USING MY KEYS";A$
8 CLS:PRINT"HELLO ";A$,"LET'S GO TO WORK. ":PRINT:PRINT:PRINT
14 INPUT"WHERE IS THE CENTER OF GRAVITY ON THE MODEL ";G
20 LET F=2
21 LET F1=0
22 LET F2=0
23 LET C1=0
24 LET C2=0
29 INPUT"S EQUALS";S
39 INPUT"LARGEST BODY TUBE DIAMETER 'D' EQUALS";D
50 LET F3=0
51 LET F4=0
60 LET C3=0
61 LET C4=0
69 INPUT"E,A,B,V";E,A,B,V
109 INPUT"NUMBER OF FINS  'U ' EQUALS";U
130 LET R=.5*D
139 INPUT"M,H";M,H
152 INPUT"DIAMETER AT BASE OF NOSE 'J ' IS?";J
159 INPUT"NOSE CONE LENGTH 'L ' IS?";L
169 INPUT"NOSE CONE TYPE IS  CONICAL=1  OGIVE=2  PARABOLIC=3";I
170 IF I>3 GOTO 169
220 CLS:ON I GOTO 230,240,250
230 LET C=.66*L
231 GOTO 259
240 LET C=.466*L
241 GOTO 259
250 LET C=.5*L
259 INPUT"DOES YOUR ROCKET HAVE A CONICAL SHOULDER?  YES=1  NO=2";I
290 CLS :ON I GOTO 308,469
308 INPUT"LENGTH OF SHOULDER 'L1 ' EQUALS";L1
319 INPUT"TOP DIAMETER OF SHOULDER 'K ' IS";K
339 INPUT"BOTTOM DIAMETER OF SHOULDER 'N ' IS";N
352 INPUT"DISTANCE FROM NOSE TIP TO SHOULDER 'O ' IS";O
360 LET F1=2*((N/J)[2-(K/J)[2)
370 LET Y=1-(K/N)
371 LET Z=1-(K/N)[2
372 LET C1=O+((L1/C)*(1+(Y/Z)))
390 INPUT"DO YOU HAVE ANOTHER SHOULDER YES=1  NO=2";I
430 CLS : ON I GOTO 440,469
440 LET F2=F1
450 LET C2=C1
460 GOTO 308
469 INPUT"DO YOU HAVE A BOATTAIL YES=1 NO=2";I
500 CLS :ON I GOTO 518,680
518 INPUT"LENGTH OF BOATTAIL 'L2' IS";L2
529 INPUT"BOATTAIL TOP DIAMETER 'P ' IS";P
549 INPUT"BOATTAIL BOTTOM DIAMETER 'Q ' IS";Q
569 INPUT"DISTANCE FROM NOSE TIP TO BOATTAIL 'T ' IS";T
590 LET Y=(Q/J)[2
591 LET Z=(P/J)[2
592 LET F3=2*(Y-Z)
600 LET Y=1-(P/Q)
601 LET Z=1-((P/Q)[2)
602 LET C3=T+((L2/3)*(1+(Y/Z)))
609 INPUT"DO YOU HAVE ANOTHER BOATTAIL YES=1  NO=2";I
640 CLS : ON I GOTO 650,680
650 LET F4=F3
660 LET C4=C3
```

Rocketry, cont'd...

```
670 GOTO 518
680 LET Y=(2*E)/(A+B)
681 LET Y=1+(Y[2)
682 LET Y=1+(SQR(Y))
680 LET Y=(2*E)/(A+B)
681 LET Y=1+(Y[2)
682 LET Y=1+(SQR(Y))
690 LET Z=((S/J)[2)*4*U
700 LET F5=Z/Y
710 IF U=6 THEN 740
720 LET X=1+(V/(S+V))
730 GOTO 750
740 LET X=1+((.5*V)/(S+V))
750 LET F6=X*F5
760 LET Y=(A*B)/(A+B)
761 LET Y=(1/6)*(A+B-Y)
770 LET Z=M*(A+(2*B))
771 LET Z=Z/(3*(A+B))
780 LET C5=H+Z+Y
790 LET F7=F+F1+F2+F3+F4+F6
800 LET W=(F*C)+(F1*C1)+(F2*C2)+(F3*C3)+(F4*C4)+(F6*C5)
810 LET C6=W/F7
820 IF C6>=(G+D-.05) THEN 850
829 PRINT"SORRY", A$,"BUT YOUR ROCKET IS UNSTABLE.":PRINT :PRINT
831 LET Y=G+D-C6
832 PRINT"CENTER OF PRESSURE MUST BE";INT(100*Y)/100  "INCHES FURTHER BACK":PRINT
834 PRINT"******* BACK TO THE OLD DRAWING BOARD ********":PRINT
840 GOTO 889
850 IF C6>G+2*D THEN 879
859 PRINT"CONGRADULATIONS",   A$ ,"YOUR ROCKET IS STABLE"
860 PRINT"AND SHOULD FLY BEAUTIFULLY!":PRINT
870 GOTO 889
879 PRINT"YOUR ROCKET IS OVERLY STABLE AND WILL NOT FLY VERTICAL IN CROSS WINDS."
882 GOTO 834
889 FOR X=1 TO 127
890 SET(X,29)
891 NEXT X
892 PRINT@ 640,"CENTER OF PRESSURE IS",INT(100*C6)/100,"INCHES FROM NOSE TIP"
893 FOR X=1 TO 127
894 SET(X,33)
895 NEXT X
899 PRINT@ 768,"TALK TO YOU LATER";A$    ,"BYE  !!!"
900 END
901 REM *REMARKS 1000 +
999 REM FOLLOWING REMARKS INDICATE WHAT VARIABLES OF THE
1000 REM PROGRAM ARE EQUAL TO  IN THE ORGINAL TIR-33
1001 REM A=A , B=B , E=L , M=M , S=S
1002 REM C=CENTER OF PRESSURE OF NOSE CONE
1003 REM D=LARGEST BODY TUBE DIAMETER
1004 REM F=NORMAL FORCE OF NOSE
1005 REM H=LENGTH OF XF
1006 REM I=YES,NO QUESTIONS
1007 REM J=DIAMETER AT BASE OF NOSE
1008 REM K=TOP DIAMETER OFF CONICAL SHOULDER,D1
1009 REM L= NOSE CONE LENGTH
1010 REM L1=LENGTH OF SHOULDER, L2=LENGTH OF BOATTAIL
1011 REM N=BOTTOM DIAMETER OF CONICAL SHOULDER
1012 REM O=DISTANCE FROM NOSE TIP TO SHOULDER
1013 REM P=DIAMETER OF BOATTAIL TOP
1014 REM Q=DIAMETER OF BOATTAIL BOTTOM
1015 REM R=RADIUS OF LARGEST BODY TUBE
1016 REM T=DISTANCE FROM NOSE TIP TO BOATTAIL
1017 REM U=NUMBER OF FINS
1018 REM V=RADIUS OF BODY BETWEEN FINS
1019 REM W=ALL FORCES * CENTER OF PRESSURES
1020 REM X=KFB
1021 REM Y AND Z USED
1022 REM F1,F2=PRESSURE ON SHOULDERS
1023 REM F3,F4=PRESSURE ON BOATTAILS
1024 REM F5=FORCE OF FINS(NOT PART OF TOTAL)
1025 REM F6=(CN)FB
1026 REM F7=TOTAL NORMAL FORCE
1027 REM C1,C2=CENTER OF PRESSURE ON SHOULDER
1028 REM C3,C4=CENTER OF PRESSURE ON BOATTAIL
1029 REM C5=CENTER OF PRESSURE OF FINS
1030 REM C6=TOTAL CENTER OF PRESSURE
```

SAMPLE RUN 1

```
THIS PROGRAM WILL DETERMINE THE CENTER OF PRESSURE OF A MODEL ROCKET

WHAT IS THE NAME OF THE PERSON USING MY KEYS? JOHN

HELLO  JOHN     LET'S GO TO WORK.

WHERE IS THE CENTER OF GRAVITY ON THE MODEL?10.55
S EQUALS?2.2
LARGEST BODY TUBE DIAMETER 'D' EQUALS?.75
E,A,B,V?2.25,2.2,1.2,.37
NUMBER OF FINS 'U' EQUALS? 4
M,H?1,10.8
DIAMETER AT BASE OF NOSE 'J' IS? .75
NOSE CONE LENGTH 'L' IS? 3
NOSE CONE TYPE IS CONICAL = 1 OGIVE = 2
PARABOLIC = 3? 2
DOES YOUR ROCKET HAVE A CONICAL SHOULDER? YES = 1 NO = 2? 2
DO YOU HAVE A BOATTAIL YES = 1 NO = 2? 2

CONGRATULATIONS JOHN YOUR ROCKET IS STABLE AND SHOULD FLY BEAUTIFULLY!

CENTER OF PRESSURE IS  11.35  INCHES FROM NOSE

TALK TO YOU LATER JOHN  BYE!!!
```

SAMPLE RUN 2

```
THIS PROGRAM WILL DETERMINE THE CENTER OF PRESSURE OF A MODEL ROCKET.

WHAT IS THE NAME OF THE PERSON USING MY KEYS? JOHN

HELLO  JOHN  LET'S GO TO WORK.

WHERE IS THE CENTER OF GRAVITY ON THE MODEL?30.0
S EQUALS?3.8
LARGEST BODY TUBE DIAMETER 'D' EQUALS? 1.6
E,A,B,V?4.1,4.2,2.3,.75
NUMBER OF FINS 'U' EQUALS?4
M,H?2.6,29
DIAMETER AT BASE OF NOSE 'J' IS?.75
NOSE CONE LENGTH 'L' is?3.2
NOSE CONE TYPE IS CONICAL = 1 OGIVE = 2
PARABOLIC = 3?2
DOES YOUR ROCKET HAVE A CONICAL SHOULDER? YES = 1 NO = 2?1
LENGTH OF SHOULDER 'L1' EQUALS?1
TOP DIAMETER OF SHOULDER 'K' IS?.75
BOTTOM DIAMETER OF SHOULDER 'N IS?1.6
DISTANCE FROM NOSE TIP TO SHOULDER 'N' IS?1.6
DISTANCE FROM NOSE TIP TO SHOULDER '0' IS? 11
DO YOU HAVE ANOTHER SHOULDER YES = 1 NO = 2?2
DO YOU HAVE A BOATTAIL YES = 1 NO = 2?1
LENGTH OF BOATTAIL 'L2' IS?1
BOATTAIL TOP DIAMETER 'P' IS?1.6
BOATTAIL BOTTOM DIAMETER 'Q' IS?.75
DISTANCE FROM NOSE TIP TO BOATTAIL 'T' IS?17
DO YOU HAVE ANOTHER BOATTAIL YES = 1 NO = 2?2

SORRY JOHN BUT YOUR ROCKET IS UN-STABLE.
CENTER OF PRESSURE MUST BE 1.11 INCHES FURTHER BACK

**BACK TO THE OLD DRAWING BOARD**

CENTER OF PRESSURE IS  30.48  INCHES FROM NOSE

TALK TO YOU LATER JOHN  BYE!!!
```

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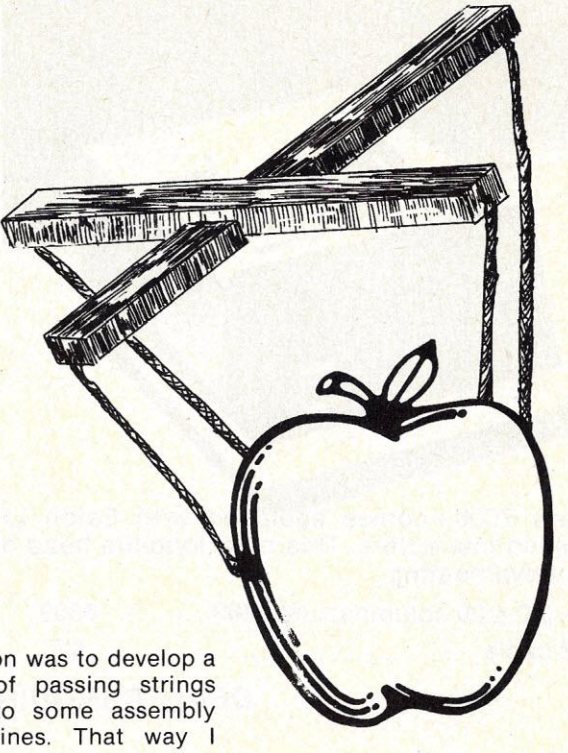
Apple Strings

Rick Geiger



There are distinct advantages to developing application programs in a higher level language such as Applesoft, but all too frequently Applesoft is either too slow or just won't do what you want. When this has happened to me, I have either revised my program or written it in assembly language. While short assembly language subroutines can be used, the difficulties in passing parameters back and forth restricts their use, especially for string processing.

Recently I've been working on a program to manipulate data in text files that reside on the Apple mini-floppy. Since Applesoft does not include an INSTR function, there is no straightforward way to locate a substring within a larger string. I also wanted to be able to use an old block mode CRT so I could create and edit a screenful of data using the editing functions of the CRT and then transmit them to the Apple.

After the return, the Applesoft program can use the modified variable like any other string variable.

My first program attempt was written entirely in Applesoft but it was so slow that characters were lost in the data transmission, and the lengthy wait for a substring search was intolerable. What to do now? I considered writing the whole program in assembly language, but I needed to do a lot of disk I/O and one look at the read/write track/sector routines documented in the DOS 3.2 manual convinced me that I didn't want to write **that** much code.

Richard G. Geiger, 901 Holiday Ct., Concord, CA 94518.

So the only solution was to develop a convenient way of passing strings back and forth to some assembly language subroutines. That way I could program the serial interface code and the substring search code in assembler and still do the disk I/O in Applesoft.

The first method I tried was to dedicate an area of memory as a string buffer and use an Applesoft POKE loop to store the string and a PEEK loop to read it. The POKEing worked okay, but the PEEK loop appended each PEEKed character, and the string concatenation overhead was murder! I tried pre-allocating the string and storing the PEEKed character into the middle of it, but the whole process was still too slow. Finally, I decided to try using the Applesoft string pointers and just pass the address of the string to the assembly language subroutines. I have seen other programs that used similar techniques, but they almost always require that only one variable be used and that it be the first one defined in the program.

The subroutine listed below will work with any string variable and set up the parameters needed for an assembler subroutine. The routine is called GET ADDRESS and makes use of the fact that the name of the last referenced variable in Applesoft is stored in locations $81 and $82 (hex). Applesoft references each string by means of a runtime descriptor that includes all of the necessary information. The address where this table of string (and other variable type) descriptors begins is contained in locations $69 and $6A. The format of a string descriptor is:

byte	contents
+0	first character of the variable name
+1	second character of the variable name
+2	length of the string
+3	low address byte
+4	high address byte
+5	0
+6	0

The call to the GET ADDRESS subroutine is immediately preceded by a variable reference that places the variable name you want into $81 and $82. A convenient one that executes quickly is:

```
100 X$+X$:CALL<subroutine address>
```

Upon return from GET ADDRESS, a location in page zero contains the string address, another page zero location contains the address of the variable pointer, and the length of the string is stored in a defined location in the GET ADDRESS subroutine.

With this information, an assembly language subroutine can access the string by indirect indexing from the page zero location containing the string address. For example, to get the third character (assuming, of course, that the string had at least three characters) you might use the following instructions:

```
LDY #2              ;LOAD OFFSET TO THE THIRD CHARACTER
LDA (STARTL),Y ;GET THE CHARACTER
```

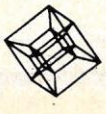
APPLE MUSIC BOARD COMPARISON: ALF & PROGRAMMA

The following is a comparison of music products available from ALF Products (the 10-5-16 Apple Music Synthesizer) and from American Micro Products/Programma International (the Music Board/Sounding Board/Juke Box).

Note that all specifications refer only to the combination of hardware and software available for purchase on March 15th, 1980 and exclude functions which would require programs not supplied. Music entry programs provided were: (ALF) **ENTRY**, version 1B: (Programma) **MUSIC** version 1.0. All information has been determined by ALF and is correct to the best of our knowledge.

Function/Feature	ALF	PROGRAMMA
Full piano scale?	Yes	No
Insert omitted notes?	Yes	No
Delete extraneous notes?	Yes	No
Can all voices in a song be edited?	Yes	No*
Automatic key signature?	Yes	No
Automatic measure bars?	Yes	No
Provisions for section repetition?	Yes	No
Programmable volume?	Yes	No*
Programmable envelopes?	Yes	No*
Cassette tape software supplied?	Yes	No*
Save songs on cassette and disk?	Yes	No*
Cables supplied for recommended setups?	Yes	No
Apple paddles required?	Yes	No
Amplifier required?	Yes	No
Programmable white noise?	No	No*
Programmable waveforms?	No	No
First board must plug into:	Any slot	Slot 3
Number of voices per board:	3	3
Maximum number of voices:	9 (3 boards)	12* (4 boards) 17* (6 boards, reloading MUSIC program for each play)
Maximum number of notes per song (48K system):	5,906 (with disk) 9,490 (without disk)	1,285
Suggested price per board:	$265.00	$129.95
Memory required with Integer BASIC:	24K (without disk) 32K (with disk)	48K (disk required)
Memory required with Applesoft BASIC:	32K (without disk) 40K (with disk)	48K (disk required)
High resolution graphics:	Sheet music shown during music entry	None*
Low resolution graphics:	Color display during playback	None
Instruction manual:	Pages: 109. Tables: 21. Illustrations: 65. Missing appendices: 0.	Pages: 11. Tables: 4. Illustrations: 8. Missing appendices: 1.
Editing commands:	EDIT (# of voices, speed, titles), DELete, INSert, TIE, backspace, forewardspace, DELETE, GOTO, MEASURE, NEW, PART, SPEED, STEREO, SUBROUTINE	EDIT (Change, Backspace), NEW, TEMPO, MERGE
Features available throughout song:	Note duration, note pitch, rest duration, attack rate, decay rate, sustain level, release rate, gap size, subroutine call, key signature, time signature, quarter note length, tempo, transpose, volume	Note duration, note pitch, rest duration

* marks specifications which contradict claims made by Programma International during demonstrations (at the 5th West Coast Computer Faire) or in printed material. Programma s claims were found to be erroneous during testing of an off-the-shelf unit. The specifications shown above have been determined by ALF and are correct to the best of our knowledge



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Apple Strings, cont'd...

where STARTL is the page zero location containing the address of the string.

The availability of the address of the pointer (in addition to the address of the string) means that you can pass a string from an assembly language subroutine to an Applesoft program. For instance, if you just received a string of characters from the serial I/O interface that you wanted to write to the disk, you would call GET ADDRESS just after referencing the string variable that you want to receive the string. Your assembly language subroutine could then use the following instructions to modify the variable pointer to map over the input buffer:

```
LDY #4          ;LOAD OFFSET TO HIGH ADDRESS BYTE OF POINTER
LDA #H,INBUF    ;LOAD HIGH BYTE OF BUFFER ADDRESS
STA (PTRL),Y    ;STORE HIGH ADDRESS BYTE INTO POINTER
DEY             ;DECREMENT OFFSET TO POINT TO LOW ADDRESS BYTE
LDA #L,INBUF    ;GET LOW BYTE OF BUFFER ADDRESS
STA (PTRL),Y    ;STORE LOW ADDRESS BYTE INTO POINTER
DEY             ;DECREMENT OFFSET TO POINT TO LENGTH BYTE
TXA             ;TRANSFER LENGTH FROM X-REG TO A-REG
STA (PTRL),Y    ;STORE LENGTH INTO POINTER
RTS             ;RETURN
```

After the return, the Applesoft program can use the modified variable like any other string variable. In the above example the buffer where the string was stored is INBUF, the page zero location holding the address of the variable descriptor is PTRL. The notation used to designate the high and low bytes of the buffer address is for the C. W. Moser 6502 assembler.

How The Subroutine Works

The call to GET ADDRESS should be directly preceded by a reference to the string variable you want. The instruction:

```
100 A$=A$ : CALL <address of GET
            ADDRESS subroutine>
```

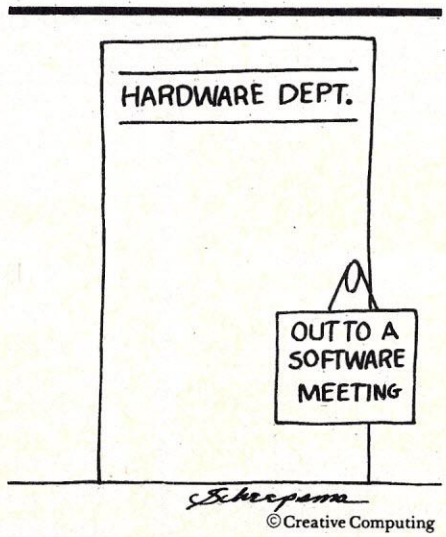
works nicely and makes sure that Applesoft doesn't later clobber the string. The only other thing to be careful of is that the variable you use (A$ in the example above) must not be a null string. If the instruction given above as an example is the first reference to the string variable, the GET ADDRESS routine will fail.

The operand of the CALL instruction must be an address, *not* a variable containing the address. If the operand is a variable, that variable will become the last variable referenced and GET ADDRESS will not do what you intended. So, assemble the GET ADDRESS subroutine and CALL the specific address at which you locate it.

The subroutine starts by clearing the index into the variable descriptor space. This index is saved by the next instruction because in the code that follows, several parts of the descriptor need to be checked. If any of the checks fail it is convenient to branch to a single place to increment the Y-REG to look at the next descriptor. Since Y-REG may have been changed during the checking and we don't want to add the logic that would be necessary to know which check failed, we simply restore the initial value from the save area.

Indirectly referencing the page zero location $69 (VTBL) we get the first character of the variable name from the variable descriptor. This is checked against the contents of $81 (CHAR1), the first character of the name of the last referenced variable. If they are not the same, we immediately go look at the next descriptor (GANXT).

If the first characters match, we bump the variable descriptor index (Y-REG) and compare the second characters. Again, if they don't match, we go look at the next descriptor. Even if the first two characters match, more checking is necessary to ensure that we have located the right variable. Real, integer and string variables may all have the same names but be distinct and separate variables. Although the documentation in the Applesoft manual would seem to indicate that you should be able to distinguish string descriptor from a real or integer descriptor by the sign bits on the name characters, I did not find this reliable.



Next, we bump the index (Y-reg) to look at the high address byte of the pointer. Since no strings can be located in page zero, this byte cannot be zero if this is a string descriptor. Then we bump the index to look at the last byte of the descriptor which *must* be zero.

The Applesoft manual seems to indicate that you should be able to distinguish a string descriptor from a real or integer descriptor by the sign bits on the name characters.

If any of the tests fail, we retrieve the initial index from the save area (YSAV) and increment it by 7 to look at the next descriptor. $FC is the final value possible in Y-REG before the index rolls over. So far I haven't found it necessary to add code to look at possible variable descriptors beyond this, but it may be required for some programs. We then transfer the incremented index into Y-REG and go through the checks for the new descriptor.

If all the checks are passed, we back up the index and extract the high address byte of the string data and store it in the page zero location STARTH. Then we back up again and store the low address byte in STARTL. Another decrement positions the index at the length byte which we extract and store in LENGTH.

In order to allow other assembler routines to modify the descriptor, we must save its address. First we compute the absolute address by adding the offset we ended up with in our search (which is in YSAV) and the starting address of the descriptor space in VTBL. We store the high and low bytes resulting from the addition in the page zero locations PTRL and PTRH.

If properly called, this routine should not fail, but just in case all the descriptors fail the checks by the time we get to an offset of $FC, we set up an error indication to tell the calling program that the search failed.

I hope these routines prove useful in augmenting your Applesoft programs with assembly language subroutines. □

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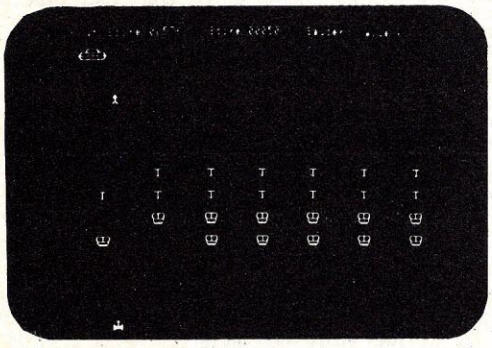

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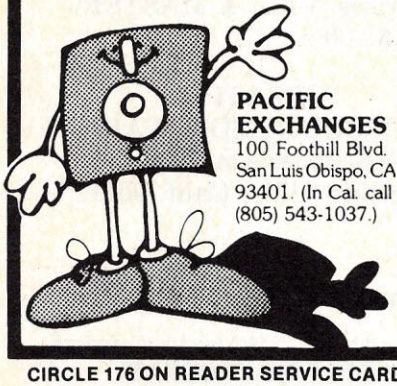

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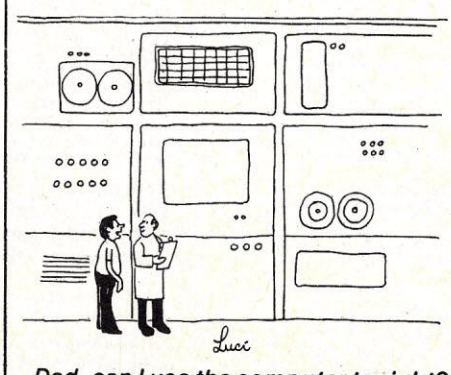
Apple Strings, cont'd...

```
0250  ;
0260  ; PAGE ZERO ADRESSES
0270  ;
0280  STARTL      .DE 6          ;BASE ADDRESS FOR STRINGS
0290  STARTH      .DE 7
0300  VTBL        .DE $69        ;CONTAINS STARTING ADDR OF VRBL POINTERS
0310  CHR1        .DE 129        ;CONTAINS FIRST CHARACTER OF LAST USED VRBL NAME
0320  CHR2        .DE 130        ;SECOND CHR OF LAST USED VRBL NAME
0330  PTRL        .DE 8          ;CONTAINS ADDR OF POINTER FOR LAST USED0VRBL
0340  PTRH        .DE 9          ;CONTAINS ADDR OF POINTER FOR LAST USED VRBL
0350  ;
0360  ;GET ADDRESS
0370  ;
0380  GETADD      LDY #0         ;CLEAR TABLE INDEX
0390  GASRCH      STY YSAV       ;SAVE INDEX INTO VRBL TABLE
0400              LDA (VTBL),Y          ;GET FIRST CHR OF VRBL NAME FROM POINTER
0410              CMP CHR1       ;IS IT THE ONE?
0420              BNE GANXT      ;BR IF NO
0430              INY  ;BUMP INDEX TO LOOK AT NEXT CHR
0440              LDA (VTBL),Y          ;GET 2ND CHR FROM POINTER
0450              CMP CHR2       ;ARE 2ND CHRS THE SAME?
0460              BNE GANXT      ;BR IF NO
0470              INY  ;BUMP INDEX BY 3 TO LOOK AT HIGH
0480              INY  ;ADDR BYTE. IF THIS IS A STRING POINTER
0490              INY  ;BYTE MUST=0
0500              LDA (VTBL),Y          ;GET HIGH ADDR BYTE
0510              BEQ GANXT      ;BR IF 0=>N_T0@ STRYNG
0520              INY  ;BUMP INDEX BY02 TO LOOK @T LAST BYTE
0530              INY  ;WHICH MUST BE 0
0540              LDA (VTBL),Y          ;GET LAST BYTE
0550              BEQ GAGOT      ;IF 0 THEN WE HAVE IT
0560  GANXT       LDA YSAV       ;GET INDEX TO PREVIOUS POINTER
0570              CLC
0580              ADC #7         ;BUMP INDEX TO NEXT OINTER
0590              CMP #252       ;ARE WE DONE
0600              BEQ GAERR      ;BR IF AT END
0610              TAY  ;TRANSFER NEW INDEX TO X-REG
0620              BNE GASRCH     ;GO LOOK AT NEW POINTER
0630  GAGOT       DEY  ;BACK UP BY 2 TO GET HIGH ADDR
0640              DEY
0650              LDA (VTBL),Y          ;GET HIGH ADDR BYTE OF STRING
0660              STA STARTH     ;SAVE
0670              DEY  ;BACK UP TO LOW ADDR BYTE
0680              LDA (VTBL),Y          ;GET LOW ADDR
0690              STA STARTL     ;STORE IT
0700              DEY  ;BACK UP TO LENGTH
0710              LDA (VTBL),Y          ;GET LENGTH
0720              STA LENGTH     ;STORE IT
0730              CLC
0740              LDA VTBL       ;GET LOW BYTE OF POINTER TABLE ADDRESS
0750              ADC YSAV       ;ADD INDEX INTO THE TABLE
0760              STA PTRL       ;STORE LOW BYTE OF POINTER ADDR
0770              LDA VTBL+1     ;GET HIGH BYTE OF OINTER TABLE ADDR
0780              ADC #0         ;ADD CARRY IF THERE WAS ONE
0790              STA PTRH       ;STORE HIGH BYTE OF POINTER ADDR
0800              LDA #0         ;LOAD SUCCESSFUL RETURN CODE
0810              BEQ GARET      ;RETURN
0820  ;
0830  ;SINCE WE ARE SEARCHING THE VRBL TBL FOR THE LAST USED VRBL IT SHOULD NO
0840  ;BE POSSIBLE FOR THIS ROUTINE TO FAIL, BUT JUST IN CASE HERE IS THE
0850  ;ERROR HANDLING CODE
0860  ;
0870  GAERR       LDA #255       ;LOAD NO FIND ERROR
0880  ;
0890  ; RETURN
0900  ;
0910  GARET       STA RTCODE     ;STORE RETURN CODE
0920              RTS
```



Dad, can I use the computer tonight?

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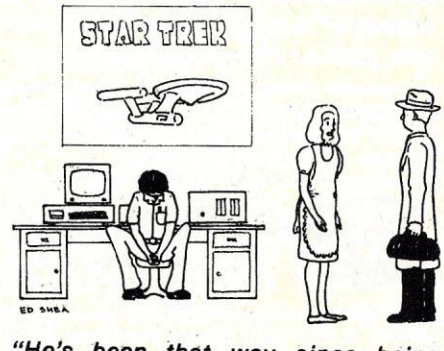

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In Search of PI

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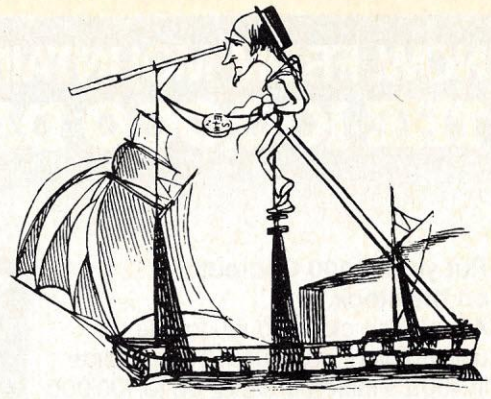


By about 2,000 B.C., the Egyptians and the Babylonians had discovered the existence of a certain constant representing the ratio of the circumference of any circle to its diameter. They had even arrived at its approximate value,

$\pi = 3$

This value was improved upon over the years, from the Babylonians'

$\pi = 3\text{-}1/8 = 3.125$

to the Egyptians'

$\pi = 4(8/9)^2 = 3.1604928\ldots$

to the Hindu value of

$\pi = 3177/1250 = 3.1416$

and the Chinese

$3.1415926 < \pi < 3.1415927$ (402 A.D.)

Thousands of years later, π was calculated correctly to 16 decimal places (Newton, 1666), 72 places (Sharp, 1705), 100 places (Machin, 1706), 127 places (De Lagny, 1719), 140 places (Vega, 1794), 200 places (Dase, 1844), 500 places (Richter, 1855) and 707 places (Shanks, 1873). In our own time, the electronic computer has made it possible to increase our accuracy to 2,037 places (ENIAC, 1949), 3,089 places (NORC, 1954), 7,480 places (Pegasus, 1957), 16,167 places (IBM 704, 1959), 100,000 places (IBM 7090, 1961), 250,000 places (IBM 7030, 1966) and even 500,000 places (CDC 6600, 1967).

Obviously, such accurate values are not intended to be used for calculations. As one mathematician put it, "Conceive a sphere constructed with a radius equal to the distance between the Earth and Sirius, or 8.7 light years (that is, light, traveling at a velocity of 186,000 miles per second, takes 8.7 years to cover this distance). Then imagine this sphere to be so packed with microbes that, in each cubic millimeter, millions of millions of these microscopic animalcula are present. Now conceive these microbes to be unpacked and distributed singly along a straight line, every two microbes as far apart from each other as we are from Sirius, 8.7 light years. If this long line is taken to represent the diameter of a circle, the circumference could be calculated to within a millionth part of a millimeter by using a value of π correct to only one hundred decimal places."

The rationale for computing π to half a million decimal places is to analyze the frequency and distribution of the digits, which can be useful in classifying π as irrational, trancendental, normal, etc. It's interesting to note that the digits of π calculated so far seem to be distributed randomly. For instance, in the first 2,000 digits, there are:

182	0's	205	5's
212	1's	200	6's
207	2's	197	7's
189	3's	202	8's
195	4's	211	9's

There is, of course, another reason for such accurate calculations. Some people enjoy setting records.

Although we won't try to break any of these records, it will be interesting to check out some of the ways π can be calculated. Among the most efficient methods are trigonometric formulas such as:

$\pi = 16\tan^{-1} 1/5 - 4\tan^{-1} 1/239$ (Machin, 1706)

since they can be expressed simply and are very easy for a computer to evaluate. Here are a few more such formulas:

$\pi = 4\tan^{-1} 1$
$\pi = 24\tan^{-1} 1/8 + 8\tan^{-1} 1/57 + 4\tan^{-1} 239$
$\pi = 4(\tan^{-1} 1/2 + \tan^{-1} 1/5 + \tan^{-1} 1/8)$
$\pi = 20\tan^{-1} 1/7 + 8\tan^{-1} 3/79$ (Euler, 1769)

Let's try using a computer to evaluate these expressions. Figures 1, 2 and 3 are programs in BASIC, Fortran and APL, respectively, for calculating π.

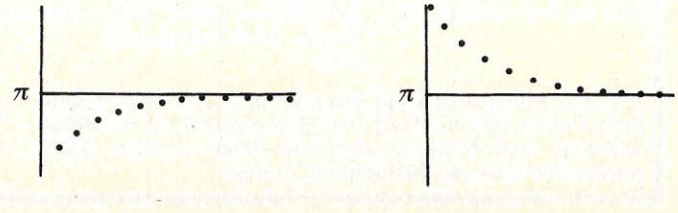
Aside from being efficient ways to calculate π, these formulas are good illustrations of APL, BASIC and FORTRAN notation. But there are more interesting ways to do this. For instance, an infinite series:

$$\pi = 4\left(1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - \ldots\right) \quad \text{(Gregory, 1671)}$$

This is a neat series, but it has very little practical value. A huge number of terms are needed to obtain an accurate value. Even with ten thousand terms, our result is correct to only three decimal places. To get a value of π accurate to 11 places, we would need over 1,000,000,000,000 terms - more terms than there are stars in the Milky Way. Figure 4 and Figure 5 are APL and BASIC programs for calculating π with this technique.

At this point it will be of interest to look more closely at the way this series converges. To do this we will use the APL scanning function shown in Figure 6, in place of the reduction used in Figures 4 and 5.

This series does not converge in a single direction, that is, according to either of the graphs



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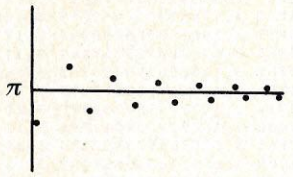
Search, cont'd...

Instead, it seems to first increase, then decrease, then increase again, and so on. It roughly follows the pattern



somewhat like the swing of a pendulum. It misses the correct value of π by a little bit less each time.

Here are three more infinite series. To save space, we'll do them all in APL (Figures 7, 8 and 9).

$$\pi = \sqrt{6\left(1 + \frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \ldots\right)}$$

$$\pi = \frac{6}{\sqrt{3}}\left(\frac{1}{1\cdot 3^0} - \frac{1}{3\cdot 3^1} + \frac{1}{5\cdot 3^2} - \frac{1}{7\cdot 3^3} + \ldots\right)$$

$$\pi = 2\left(1 + \frac{1\cdot 1}{2\cdot 3} + \frac{1\cdot 3\cdot 1}{2\cdot 4\cdot 5} + \frac{1\cdot 3\cdot 5\cdot 1}{2\cdot 4\cdot 6\cdot 7} + \ldots\right)$$

How do the speeds of these series compare with the speed of the first one we looked at?

Here's an infinite product:

$$\pi = 4\left(\frac{2\cdot 4\cdot 4\cdot 6\cdot 6\cdot 8\ldots}{3\cdot 3\cdot 5\cdot 5\cdot 7\cdot 7\ldots}\right) \qquad \text{(Wallis, 1655)}$$

Figures 10 and 11 are BASIC and Fortran programs using this approach.

If lines 40 and 50 of the BASIC program are interchanged, a converging of the products can be observed in the subsequent RUN. This result is similar to what happened with the first series. In that case, the "pendulum action" was caused by the alternating sum; here, it's because we are alternately multiplying the product by a little less than one and a little more than one.

The next expression we'll look at is also an infinite product. It's a very elegant one:

$$= \frac{2}{\sqrt{1/2}\sqrt{1/2 + 1/2\sqrt{1/2}}\ \sqrt{1/2 + 1/2\sqrt{1/2 + 1/2\sqrt{1/2}}}\ldots}$$

Each term in the demoninator is equal to the square root of 1/2 plus 1/2 of the proceding term. Figure 12 is a BASIC approach to this technique.

Another way π can be calculated is by finding the perimeters of polygons that approximate a circle. The more sides the polygon has, the more accurate the value of π. Let's try it out in BASIC (Figure 13).

This approach seems to work, but there is a fallacy in the program. To convert degrees to radians in line 30, we need the value of π before we even start! A much more straightforward way to find the perimeter of a polygon, without using trigonometry, is illustrated in Figure 14.

The last expression we'll look at is a continued fraction:

$$\pi = \cfrac{4}{1 + \cfrac{1^2}{2 + \cfrac{3^2}{2 + \cfrac{5^2}{2 + \cfrac{7^2}{2 + \ldots}}}}}$$

Figure 15 is a recursive APL function to evaluate it.

This is a fascinating expression. So are many other series we've looked at. In the final analysis, however, the most efficient methods of computing π would have to be trigonometric formulas such as

$$\pi = 24\tan^{-1}1/8 + 8\tan^{-1}1/57 + 4\tan^{-1}1/239$$

They are easily expressed and easily evaluated. But polygons, continued fractions and infinite series and products are much more interesting; they remain the favorite methods of calculating □

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```
PRINT 16*ATN(1/5)-4*ATN(1/239)
 3.14159

READY

PRINT 4*ATN(1)
 3.14159

READY

PRINT 24*ATN(1/8)+8*ATN(1/57)+4*ATN(1/239)
 3.14159

READY

PRINT 4*(ATN(1/2)+ATN(1/5)+ATN(1/8))
 3.14159

READY

PRINT 20*ATN(1/7)+8*ATN(3/79)
 3.14159

READY
```

Figure 1.

```
      4×-\÷¯1+2×⍳10000
4 2.666666666666667 3.466666666666667 2.895238095238095
  3.339682539682541 2.976046176046176 3.283738483738484
  3.017071817071817 3.252365934718876 3.041839618929402
  3.232315809405593 3.058402765927332 3.218402765927332
  3.070254617779183 3.208185652261942 3.079153394197426
  3.200365515409547 3.086079801123833 3.194187909231941
  3.091623806667838 3.189184782277594 3.096161526463641
  3.185050415352533 3.099944032373806 3.181576685435031
  3.103145312886011 3.178617010999219 3.105889738271946
  3.176065176868437 3.108268566698946 3.173842337190749
  3.110350273698685 3.171688735237147 3.112187242699833
  3.170158257192587 3.113820229023573 3.168614749571518
  3.115281416238185 3.167229468186237 3.116596556793831
  3.165979272843214 3.117786501758877 3.164845325288288
  3.118868313794036 3.163812134018755 3.119856090062711
  3.162866842750883 3.120761579592988 3.16199869299505
  3.121594652591009 3.161198612987049 3.122363661530738
  3.160458899625976 3.123075722055883 3.159772969762305
  3.123736933726269 3.159135163814764 3.124352555119112
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  3.155676462307473 3.127704434335445 3.155290641231997
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  3.154579119086656 3.128772667473752 3.154250374480122
  3.129093141775719 3.153937862272614 3.129397984972
  3.153640409214424 3.129688313406041 3.153356952459295
  3.129965139593798 3.153086526877035 3.130229384019892
  3.15282825407639 3.130481885361306 3.152581332875118
  3.13072340937785 3.152345030999472 3.130954656067921
  3.152118677831942 3.131176269454979 3.151901658056015
  3.131388837543194 3.151693406071113 3.13159290355855
```

Figure 6.

```
FLRTRAN IV G1  RELEASE 2.0              MAIN            DATE = 78157      19/26/56            PAGE 0001

0001                  DOUBLE PRECISION PI                                          PI100010
0002                  PI=16.0D0*DATAN(1.0D0/5.0)-4.0D0*DATAN(1.0D0/239.0D0)        PI100020
0003                  WRITE (6,100) PI                                             PI100030
0004                  PI=4.0D0*DATAN(1.0D0)                                        PI100040
0005                  WRITE (6,100) PI                                             PI100050
0006                  PI=24.0D0*DATAN(1.0D0/8.0D0)+8.0D0*DATAN(1.0D0/57.0D0)       PI100060
0007                  PI=PI+4.0D0*DATAN(1.0D0/239.0D0)                             PI100070
0008                  WRITE (6,100) PI                                             PI100080
0009                  PI=4.0D0*(DATAN(0.5D0)+DATAN(1.0D0/5.0D0)+DATAN(1.0D0/8.0D0)) PI100090
0010                  WRITE (6,100) PI                                             PI100100
0011                  PI=20.0D0*DATAN(1.0D0/7.0D0)+8.0D0*DATAN(3.0D0/79.0D0)       PI100110
0012                  WRITE(6,100) PI                                              PI100120
0013            100   FORMAT (1D24.15)                                             PI100130
0014                  STOP                                                         PI100140
0015                  END                                                          PI100150
```

Figure 2.

```
      +/16 ¯4×¯30÷5 239
3.141592653589793
      4×¯301
3.141592653589793
      +/24 8 4×¯30÷8 57 239
3.141592653589793
      4×+/¯30÷2 5 8
3.141592653589793
      +/20 8×¯301 3÷7 79
3.141592653589793
```

Figure 3.

```
      4×-/÷¯1+2×⍳10000
3.141492653590043
```

Figure 4.

```
LISTNH

10 P=0
20 S=1
30 FOR I=1 TO 1999 STEP 2
40 P=P+S/I
50 S=-S
60 NEXT I
70 PRINT 4*P
80 END

READY

RUNNH

 3.14059

READY
```

Figure 5.

```
      (6×1++/÷(⍳100)*2)*0.5
3.97616692319492
```

Figure 7.

```
    (6÷3*0.5)×-/÷(¯1+2×⍳100)×3*¯1+⍳100
3.141592653589793
```

Figure 8.

```
      ∇ PI←F1 N
[1]   PI←1
[2]   L←1
[3]   PI←PI+(÷1+L×2)××/(¯1+2×⍳L)÷2×⍳L
[4]   L←L+1
[5]   →(L≤N)/3
[6]   PI←2×PI
      ∇
      F1 10
2.800169963505807
      F1 100
3.029268738257351
      F1 1000
3.105926515652103
```

Figure 9.

```
LIST

10 P=1
20 FOR I=4 TO 2000 STEP 2
30 P=P*(I/(I-1))*(I/(I+1))
40 NEXT I
50 PRINT 8/3*P
60 END

READY

RUN

3.14069

READY
```

Figure 10.

Search, cont'd...

```
FORTRAN IV G1  RELEASE 2.0          MAIN        DATE = 78157      19/40/48          PAGE 0001

0001                  DOUBLE PRECISION PI,I                                    PI200010
0002                  I=4.0D0                                                  PI200020
0003            100   PI=PI*(I/(I+1))*(I/(I-1))                                PI200030
0004                  I=I+2.0D0                                                PI200040
0005                  IF (I.LT.2.0D4) GO TO 100                                PI200050
0006                  PI=8.0D0/3.0D0*PI                                        PI200060
0007                  WRITE (6,101) PI                                         PI200070
0008            101   FORMAT (1D24.15)                                         PI200080
0009                  STOP                                                     PI200090
0010                  END                                                      PI200100
```

Figure 11.

```
LISTNH

10 P=1
20 T=SQR(1/2)
30 FOR I=1 TO 10
40 P=P*T
50 T=SQR(1/2+1/2*T)
60 NEXT I
70 PRINT 2/P
80 END

READY

RUNNH

 3.14159

READY
```

Figure 12.

```
LISTNH

10 FOR I=3 TO 19
20 S=2^I
30 R=6.28318/S
40 PRINT S,(S*SIN(R)*COS(R))/2
50 NEXT I
60 END

READY

RUNNH

 8              2
 16             2.82843
 32             3.06147
 64             3.12144
 128            3.13655
 256            3.14033
 512            3.14127
 1024           3.14151
 2048           3.14157
 4096           3.14159
 8192           3.14159
 16384          3.14159
 32768          3.14159
 65536          3.14159
 131072         3.14159
 262144         3.14159
 524288         3.14159

READY
```

Figure 13.

```
      ∇F2[□]∇
      ∇ PI←F2 K
[1]   N←6
[2]   A←1
[3]   PI←N×A
[4]   →(N≥K)/8
[5]   N←2×N
[6]   A←(2-(4-A×A)*0.5)*0.5
[7]   →3
[8]   PI←PI*2
      ∇

      F2 10
 3.105828541
      F2 100
 3.141452472
      F2 1000
 3.141590463
```

Figure 14.

```
      ∇F3[□]∇
      ∇ PI←L F3 N
[1]   →(L>N)/6
[2]   L←L+2
[3]   PI←2+(L×L)*L F3 N
[4]   PI←4*1+*PI
[5]   →0
[6]   PI←1
      ∇

      1 F3 10
3.273973906
      1 F3 11
3.273972669
      1F3 12
3.273972669

      1 F3 13
3.273972694
      1 F3 14
3.273972694
      1 F3 15
3.273972693
      1 F3 16
3.273972693
      1 F3 16
3.273972693
```

Figure 15.

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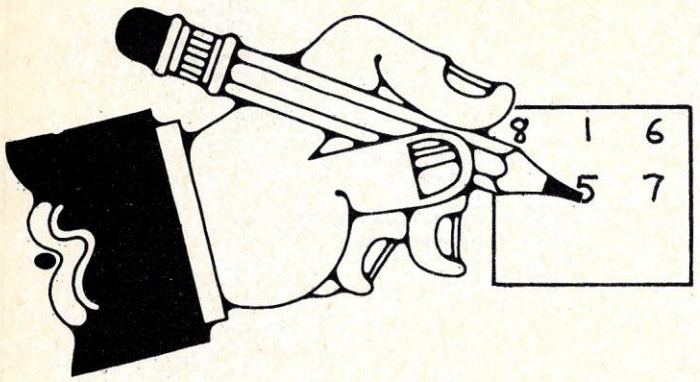

Magic Squares & Cubes

Stuart M. Anstis and Ian Howard

A magic square is a square array of the first N^2 integers, arranged so that every row, column and diagonal add up to the same number, which is called the "constant." N is the "order" of the square. The constant is the sum of all the numbers divided by N. The formula is $(1+2+3+ \ldots N^2)/N = \frac{1}{2}(N^3+N)$.

There is only one possible 3×3 magic square, which is shown in Figure 1. Of course, the square can be rotated so that every row becomes a column, and each of the four squares obtained by rotation can be reflected in a mirror to get a reversed array. But this trivial set of reflections and rotations is regarded as eight examples of the same square. At higher orders the number of possible squares expands dramatically: Not counting reflections and rotations, there are 880 order-4 squares and over 275 million order-5 squares.

8	1	6
3	5	7
4	9	2

FIGURE 1.

Magic squares are very old. They were first discovered by the ancient Chinese. According to Chinese legend, the first magic square was first noticed by the mythical Emporer Yu while he was walking beside the river Lo. He saw a magic square written in Chinese characters on the back of a tortoise! Many artists and mathèmaticians have been fascinated by magic squares. Durer's famous engraving "Melancholy" contains a 4×4 magic square, in which the two central numbers in the bottom row are 15, 14 — which is the date of the engraving. Benjamin Franklin once wrote:

"In my younger days, having once more leisure time (which I still think I might of employed more usefully) I had amused myself in making these kind of magic squares, and, at length acquired such a knack at it, that I could fill the cells of any magic square of reasonable size with a series of numbers as fast as I could write them, disposed in such a manner that the sum of every row, horizontal, perpendicular or diagonal, should be equal; but not being satisfied with these, which I looked on as common and easy things, I imposed on myself more difficult tasks, and succeeded in making other magic squares with a variety of properties, and much more curious."[1]

The standard book on magic squares is by W. S. Andrews (1917, 1960)[2] and there is a well illustrated account by van Delft and Botermans (1978).[3] Martin Gardner wrote an article on magic squares in the January 1976 edition of the **Scientific American.**[4] Computer programs for making magic squares by the algorithms of Franklin and de la Loubere have been published by Piele (1977)[5] and by Spencer (1977).[6]

Recently, one of us (Howard) has discovered a new algorithm for making magic squares, which can be generalized to three or more dimensions to make magic cubes or hypercubes.[7] The order N (i.e., the number of cells per side of the square or cube) must be a prime number, or a product of two primes, but there is no upper limit on size. For instance, it would be easy to generate a nine-dimensional hypercube of order 997. The method is illustrated in Figure 2, and the computer program is listed in Figure 4.

Suppose you want a 5 x 5 magic square. In lines 92 to 120 the user asks for a 2-dimensional square of order 5. Lines 160 to 360 insert the digits 0, 1, 2, 3, 4 into the first row in random order. In lines 400 to 550 these digits are rewritten in the same order, but shifted two places to the right in successive rows (Figure 2a). If the digits are pushed right off the square on the right, they wrap around and are put into the left hand side of the square (Figure 2a). Since N(=5) is not divisible by 2, this gives a Latin square in which no digit occurs twice in the same row, column or diagonal. (Ignore lines 600 to 745 for the moment; they apply only to a magic cube, not a magic square; we will come back to them later.) Line 800 is particularly important. The array is reflected left-to-right to produce a mirror image, which is superimposed on the original array. This mirror image is multiplied by N(=) and added to the original array. Thus the original first row in Figure 2a is 1, 0, 2, 3, 4. The reflected array is superimposed in heavy type in Figure 2b, giving **41 30 22 14**. The first digit in each pair (in heavy type) is now multiplied by 5 and added to the second digit, thus:

(5*4)+1 = 21 (5*3)+0 = 15
(5*2)+2 = 12 (5*0)+3 = 3
(5*1)+4 = 9

1	0	2	3	4
3	4	1	0	2
0	2	3	4	1
4	1	0	3	2
2	3	4	1	0

FIGURE 2A.

41	30	22	03	14
23	04	11	40	32
10	42	33	24	01
24	**31**	**00**	**13**	**42**
02	13	44	31	20

FIGURE 2B.

Stuart Anstis & Ian Howard, York University, Dept. of Psychology, 4700 Keele St., Downsview, Ontario, M3J 1P3.

Magic, cont'd...

Each two-digit number appears only once. These numbers **41**, **30**, **22**, **03**, **14**, are really expressed in base-5, and the operation of multiplying the first digit by 5 and adding to the second digit is simply a way of converting the numbers to base-10 (decimal). The result (Figure 2c) is that the integers from 0 to 24 are now written into the array and form a magic square. The computer adds one to each number (to give numbers from 1 to 25 instead of 0 to 24; this step is not essential). This is done in line 810, and the results are printed out in lines 850 to 870. Lines 880 to 1200 print out the sums of each row and column, while each add up to the constant (=65 for an order-5 square). To avoid cluttering the printout, the program does not sum up the diagonals, but if you check you will find that both major diagonals add up to the constant of 65, and so do all the "broken diagonals." Imagine that the magic square is wrapped around a cylinder. You can start a diagonal at (say) the center of the top row, and when it disappears off the right hand edge it wraps around and reappears one row further down on the left hand edge. Every broken diagonal also adds up to 65. The first RUN gives a 5 x 5 square which is identical to the one in Figure 2c (except that one has been added to each number).

21	15	12	9	3
13	0	6	17	20
5	22	18	1	4
19	11	0	23	7
2	8	24	10	16

FIGURE 2C.

Another nice feature of the program is that it produces a *different* magic square on each RUN. This is because the digits are randomly rearranged on each RUN.

The smallest magic square which this program can produce is 5 x 5. The smallest 3-dimensional cube is 11 x 11 x 11. (5 and 11 are the smallest primes which are greater than 2N, i.e., 2^2 and 2^3 respectively.) To make a cube, the first stage is the same as for a square: the first row is filled with integers from 0 to N in random order, and these are then rewritten in the same order, but shifted 2 places to the right, in successive rows. The whole plane is then rewritten into the N different planes, in the same order but shifted to the right by 4 places in successive planes (lines 600 to 745). Each plane is then reflected left-to-right to give a two-digit number, as before, and then it is also reflected top-to-bottom (line 800), to give a three-digit number in base-11. To convert it into decimal form, the first number is multiplied by N^2 (=11×11), the second digit is multiplied by 11, and the three numbers are then added together.

Confused? Here's an example. Consider one plane of an 11 x 11 x 11 magic cube. The first step is to fill the first row with the numbers 0, 1, 2, 3, . . . 9, 10, 11 in random order, then fill in all other rows with the same digits in the same order, but shifted 2 places to the right between rows, and 4 places to the right between planes. Suppose you have done this, and the corner digits in plane #1 turn out to be 1, 7, 5 and 9 (Figure 3a). Now flip the plane left-to-right, and you have Figure 3b, with a two-digit number in each corner. Flip the plane again top-to-bottom, and you have a three-digit number in each corner (Figure 3c). Now what? Well, these three-digit numbers are in base-11, so find out their values by multiplying out.

5, 7, 1 in the top left corner =
(121*5)+(11*7)+1 = 683.
9, 1, 7 (top right) =
(121*5)+(11*7)+1 = 1107.
1, 9, 5 = (121*1)+(11*9)+5+225.
7, 5, 9 + (121*7)+(11*5)+9 = 911.

Add one to each of these numbers (Figure 3d). Now look at the four corners of the program PRINTout for the 11 x 11 x 11 cube. Recognize the numbers you find there? You could figure all the numbers out in this way, but fortunately you don't have to because the computer does it all for you.

1	7
5	9

FIGURE 3A.

71	17
95	59

FIGURE 3B.

571	917
195	759

FIGURE 3C.

683	1107
225	911

FIGURE 3D.

684	1108
226	912

FIGURE 3E.

Still confused? Don't worry. Remember — you don't need to understand the math to use the program. Happy computing! □

References

(1) Franklin, Benjamin. *Letters and Papers on Philosophical Subjects.* London, 1769.
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(3) Van Delft, P. and Botermans, J. *Creative Puzzles of the World.* Harry N. Abrams, Inc., New York, 1978.
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(5) Piele, D. Magic Squares on the computer. In David Ahl (Ed.) *The Best of Creative Computing,* Vol. 2, 1977.
(6) Spencer, D. D. *Game playing with BASIC.* Hayden Book Co. Inc., 1977.
(7) Howard, I. P. Pan-Diagonal, Associative Magic Cubes and m-Dimensional Magic Arrays. *Journal of Recreational Mathematics,* 9(4), 1976-77.

Acknowledgements

This program was written on an Apple II computer which was purchased through Grant A0260 from the National Science and Engineering Council of Canada.

We originally planned to tell you all about Inventory-2 in this month's ad. Unfortunately when we sat down at the drawing board and listed all of Inventory-2's capabilities and features it became obvious that what we really needed was a four page spread, and not a miserly 9.3 square inches. Also unfortunately, the tightwad who controls the money around here said that a four page spread would consume the entire advertising budget through 1982.

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```
LIST

10  REM  ***************************
20  REM
30  REM  MAGIC SQUARES AND CUBES
40  REM
50  REM    BY STUART ANSTIS
60  REM
70  REM         1979
80  REM
90  REM  ***************************
92  PRINT "DO YOU WANT A 2-D MAGIC SQUARE OR A 3-D MAGIC CUBE?"
94  INPUT "TYPE 2 FOR A SQUARE, 3 FOR A CUBE.....";D$
95 D =  VAL (D$)
96  IF D < > 2 AND D < > 3 THEN  GOTO 94
98  IF D > 2 THEN  GOTO 116
100  PRINT "WHAT SIZE MAGIC SQUARE? ";
110  INPUT "TYPE A PRIME NUMBER GREATER THAN 3.....";N
112  IF 2 * (N / 2 -  INT (N / 2)) < 0.1 THEN  GOTO 110
114  GOTO 125
116  PRINT "WHAT SIZE MAGIC CUBE? ";
118  INPUT "TYPE A PRIME NUMBER EQUAL TO OR GREATER THAN 11.....";N
120  IF 2 * (N / 2 -  INT (N / 2)) < 0.1 THEN  GOTO 118
125 J = 0
128  PRINT : PRINT : PRINT
130  DIM V(N)
140  DIM S(N,N),T(N,N),U(N,N)
150  DIM ROW(N),COL(N)
155  DIM J(N,N)
160  REM  ***************************
170  REM
180  REM         FIRST ROW
190  REM  INSERT DIGITS FROM 1 TO
200  REM   N IN RANDOM ORDER
210  REM
220  REM  ***************************
300  FOR C = 1 TO N
310 V(C) =  INT (N *  RND (1))
320  FOR K = 1 TO C - 1
330  IF V(C) = V(C - K) THEN  GOTO 310
340  NEXT K
350 U(1,C) = V(C)
360  NEXT C
400  REM  ********************
410  REM    SHIFT DIGITS 2 PLACES
420  REM  TO RIGHT IN SUCCESSIVE
430  REM         ROWS
440  REM     L=(C-2) MOD N
450  REM  ********************
500  FOR R = 2 TO N
510  FOR C = 1 TO N
520 L = N * ((C - 3) / N -  INT ((C - 3) / N)) + 1
530 U(R,C) = U(R - 1,L)
540  NEXT C
550  NEXT R
600  REM  ********************
610  REM  SHIFT DIGITS 4 PLACES
620  REM  TO RIGHT IN SUCCESSIVE
630  REM         PLANES
635  REM  J=(C-4*P) MOD N
640  REM  ********************
700  FOR P = 1 TO N ^ (D - 2)
710  FOR R = 1 TO N
720  FOR C = 1 TO N
730 J = N * ((C - 4 * P) / N -  INT ((C - 4 * P) / N)) + 1
732 J =  INT (J + 0.5)
740 S(R,C) =  INT (U(R,J))
745  NEXT C: NEXT R
750  REM  ********************
760  REM  U(R,C) FLIPPED LEFT/RIGHT
770  REM  AND UP/DOWN;
780  REM  T(R,C)=N*(L/R MIRROR IMAGE) +
790  REM        N*N*(U/D MIRROR IMAGE)
795  REM  ********************
797  FOR R = 1 TO N: FOR C = 1 TO N
800 T(R,C) = S(R,C) + N * S(R,N - C + 1) + N * N * S(N - R + 1,C)
      2)
810 SS =  INT (T(R,C)) + 1
820 ROW(R) = ROW(R) + SS
830 COL(C) = COL(C) + SS
840  REM  FORMATTING STATEMENT *****
850 T = 5 -  LOG (SS + 1) /  LOG (10)
855  REM :PRINT THE MAGIC SQUARE *****
860  PRINT  SPC( T);SS;
865 T(R,C) = 0
866 SS = 0
870  NEXT C
880  REM  PRINT SUMS OF ROWS *****
900  PRINT "  ***  ";ROW(R)
910 ROW(R) = 0
920  PRINT
930  NEXT R
1000  REM : PRINT SUMS OF COLUMNS *****
1010  FOR C = 1 TO N
1020  PRINT "******";
1030  NEXT C
1040  PRINT
1050  FOR C = 1 TO N
1060 T = 5 -  LOG (COL(C)) /  LOG (10)
1070  PRINT  SPC( T);COL(C);
1080  NEXT C
1090  FOR C = 1 TO N:COL(C) = 0: NEXT C
1100  PRINT : PRINT : PRINT
1200  NEXT P
2000  END
```

```
 RUN
DO YOU WANT A 2-D MAGIC SQUARE OR A 3-D MAGIC CUBE?
TYPE 2 FOR A SQUARE, 3 FOR A CUBE.....2
WHAT SIZE MAGIC SQUARE? TYPE A PRIME NUMBER GREATER THAN 3.....5


   22   16   13    4   10  ***  65
   14    5    7   21   18  ***  65
    6   23   19   15    2  ***  65
   20   12    1    8   24  ***  65
    3    9   25   17   11  ***  65
**************************
   65   65   65   65   65

]RUN
DO YOU WANT A 2-D MAGIC SQUARE OR A 3-D MAGIC CUBE?
TYPE 2 FOR A SQUARE, 3 FOR A CUBE.....2
WHAT SIZE MAGIC SQUARE? TYPE A PRIME NUMBER GREATER THAN 3.....5


   17   23    1   15    9  ***  65
    5   14    7   18   21  ***  65
    8   16   25    4   12  ***  65
   24    2   13    6   20  ***  65
   11   10   19   22    3  ***  65
**************************
   65   65   65   65   65

]RUN
DO YOU WANT A 2-D MAGIC SQUARE OR A 3-D MAGIC CUBE?
TYPE 2 FOR A SQUARE, 3 FOR A CUBE.....3
WHAT SIZE MAGIC CUBE? TYPE A PRIME NUMBER EQUAL TO OR GREATER THAN
11.....11

  684 1088   39  317  529  751  368 1305  906  231 1108  ***  7326
   44  316  530  758  369 1307  903  223 1105  689 1082  ***  7326
  535  752  374 1306  904  230 1106  691 1079   36  313  ***  7326
  366 1303  909  224 1111  690 1080   43  314  537  749  ***  7326
  911  221 1103  687 1085   37  319  536  750  373 1304  ***  7326
 1110  688 1087   34  311  533  755  367 1309  910  222  ***  7326
 1086   35  318  534  757  364 1301  907  227 1104  693  ***  7326
  312  539  756  365 1308  908  229 1101  685 1083   40  ***  7326
  753  370 1302  913  228 1102  692 1084   42  309  531  ***  7326
 1299  905  225 1107  686 1089   41  310  538  754  372  ***  7326
  226 1109  683 1081   38  315  532  759  371 1300  912  ***  7326
******************************************************************
 7326 7326 7326 7326 7326 7326 7326 7326 7326 7326 7326

 1251  873  132 1185  662 1077   17  328  595  762  434  ***  7326
  124 1182  667 1071   22  327  596  769  435 1263  870  ***  7326
  669 1068   14  324  601  763  440 1262  871  131 1183  ***  7326
   21  325  603  760  432 1259  876  125 1188  668 1069  ***  7326
  602  761  439 1260  878  122 1180  665 1074   15  330  ***  7326
  433 1265  877  123 1187  666 1076   12  322  599  766  ***  7326
  874  128 1181  671 1075   13  329  600  768  430 1257  ***  7326
 1178  663 1072   18  323  605  767  431 1264  875  130  ***  7326
 1073   20  320  597  764  436 1258  880  129 1179  670  ***  7326
  321  604  765  438 1255  872  126 1184  664 1078   19  ***  7326
  770  437 1256  879  127 1186  661 1070   16  326  598  ***  7326
******************************************************************
 7326 7326 7326 7326 7326 7326 7326 7326 7326 7326 7326

  306  584  740  445 1327  884  198 1141  629  978   94  ***  7326
  747  446 1329  881  190 1138  634  972   99  305  585  ***  7326
 1328  882  197 1139  636  969   91  302  590  741  451  ***  7326
  191 1144  635  970   98  303  592  738  443 1325  887  ***  7326
  632  975   92  308  591  739  450 1326  889  188 1136  ***  7326
   89  300  588  744  444 1331  888  189 1143  633  977  ***  7326
  589  746  441 1323  885  194 1137  638  976   90  307  ***  7326
  442 1330  886  196 1134  630  973   95  301  594  745  ***  7326
  891  195 1135  637  974   97  298  586  742  447 1324  ***  7326
 1140  631  979   96  299  593  743  449 1321  883  192  ***  7326
  971   93  304  587  748  448 1322  890  193 1142  628  ***  7326
******************************************************************
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```

NEW! TPM* for TRS-80 Model II
NEW! System/6 Package
Computer Design Labs

Z80* Disk Software

We have acquired the rights to all TDL software (& hardware). TDL software has long had the reputation of being the best in the industry. Computer Design Labs will continue to maintain, evolve and add to this superior line of quality software.

— Carl Galletti and Roger Amidon, owners.

Software with Manual/Manual Alone

All of the software below is available on any of the following media for operation with a Z80 CPU using the CP/M* or similar type disk operating system (such as our own TPM*).

for TRS-80* CP/M (Model I or II)
for 8" CP/M (soft sectored single density)
for 5¼" CP/M (soft sectored single density)
for 5¼" North Star CP/M (single density)
for 5¼" North Star CP/M (double density)

BASIC I

A powerful and fast Z80 Basic interpreter with EDIT, RENUMBER, TRACE, PRINT USING, assembly language subroutine CALL, LOADGO for "chaining", COPY to move text, EXCHANGE, KILL, LINE INPUT, error intercept, sequential file handling in both ASCII and binary formats, and much, much more. It runs in a little over 12 K. An excellent choice for games since the precision was limited to 7 digits in order to make it one of the fastest around. $49.95/$15.

BASIC II

Basic I but with 12 digit precision to make its power available to the business world with only a slight sacrifice in speed. Still runs faster than most other Basics (even those with much less precision). $99.95/$15.

BUSINESS BASIC

The most powerful Basic for business applications. It adds to Basic II with random or sequential disk files in either fixed or variable record lengths, simultaneous access to multiple disk files, PRIVACY command to prohibit user access to source code, global editing, added math functions, and disk file maintenance capability without leaving Basic (list, rename, or delete). $179.95/$25.

ZEDIT

A character oriented text editor with 26 commands and "macro" capability for stringing multiple commands together. Included are a complete array of character move, add, delete, and display function. $49.95./$15.

ZTEL

Z80 Text Editing Language - Not just a text editor. Actually a language which allows you to edit text and also write, save, and recall programs which manipulate text. Commands include conditional branching, subroutine calls, iteration, block move, expression evaluation, and much more. Contains 36 value registers and 10 text registers. Be creative! Manipulate text with commands you write using Ztel. $79.95/$25.

TOP

A Z80 Text Output Processor which will do text formatting for manuals, documents, and other word processing jobs. Works with any text editor. Does justification, page numbering and headings, spacing, centering, and much more! $79.95/$25.

MACRO I

A macro assembler which will generate relocateable or absolute code for the 8080 or Z80 using standard Intel mnemonics plus TDL/Z80 extensions. Functions include 14 conditionals, 16 listing controls, 54 pseudo-ops, 11 arithmetic/logical operations, local and global symbols, chaining files, linking capability with optional linker, and recursive/reiterative macros. This assembler is so powerful you'll think it is doing all the work for you. It actually makes assembly language programming much less of an effort and more creative. $79.95/$20.

MACRO II

Expands upon Macro I's linking capability (which is useful but somewhat limited) thereby being able to take full advantage of the optional Linker. Also a time and date function has been added and the listing capability improved. $99.95/$25.

LINKER

How many times have you written the same subroutine in each new program? Top notch professional programmers compile a library of these subroutines and use a Linker to tie them together at assembly time. Development time is thus drastically reduced and becomes comparable to writing in a high level language but with all the speed of assembly language. So, get the new CDL Linker and start writing programs in a fraction of the time it took before. Linker is compatible with Macro I & II as well as TDL/Xitan assemblers version 2.0 or later. $79.95/$20.

DEBUG I

Many programmers give up on writing in assembly language even though they know their programs would be faster and more powerful. To them assembly language seems difficult to understand and follow, as well as being a nightmare to debug. Well, not with proper tools like Debug I. With Debug I you can easily follow the flow of any Z80 or 8080 program. Trace the program one step at a time or 10 steps or whatever you like. At each step you will be able to see the instruction executed and what it did. If desired, modifications can then be made before continuing. It's all under your control. You can even skip displaying a subroutine call and up to seven breakpoints can be set during execution. Use of Debug I can pay for itself many times over by saving you valuable debugging time. $79.95/$20.

DEBUG II

This is an expanded debugger which has all of the features of Debug I plus many more. You can "trap" (i.e. trace a program until a set of register, flag, and/or memory conditions occur). Also, instructions may be entered and executed immediately. This makes it easy to learn new instructions by examining registers/memory before and after. And a RADIX function allows changing between ASCII, binary, decimal, hex, octal, signed decimal, or split octal. All these features and more add up to give you a very powerful development tool. Both Debug I and II must run on a Z80 but will debug both Z80 and 8080 code. $99.95/$20.

ZAPPLE

A Z80 executive and debug monitor. Capable of search, ASCII put and display, read and write to I/O ports, hex math, breakpoint, execute, move, fill, display, read and write in Intel or binary format tape, and more! on disk

APPLE

8080 version of Zapple

NEW! TPM now available for TRS-80 Model III!

TPM*

A NEW Z80 disk operation system! This is not CP/M*. It's better! You can still run any program which runs with CP/M* but unlike CP/M* this operating system was written specifically for the Z80* and takes full advantage of its extra powerful instruction set. In other words its not warmed over 8080 code! Available for TRS-80* (Model I or II). Tarbell, Xitan DDDC, SD Sales "VERSA-FLOPPY", North Star (SD&DD), and Digital (Micro) Systems. $79.95/$25.

SYSTEM MONITOR BOARD (SMB II)

A complete I/O board for S-100 systems. 2 serial ports, 2 parallel ports, 1200/2400 baud cassette tape interface, sockets for 2K of RAM, 3-2708/2716 EPROM's or ROM, jump on reset circuitry. Bare board $49.95/$20.

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2KX8 masked ROM of Zapple monitor. Includes source listing $34.95/$15.

PAYROLL (source code only)

The Osborne package. Requires C Basic 2.
5" disks $124.95 (manual not included)
8" disks $ 99.95 (manual not included)
Manual $20.00

ACCOUNTS PAYABLE/RECEIVABLE (source code only)

By Osborne, Requires C Basic 2
5" disks $124.95 (manual not included)
8" $99.95 (manual not included)
Manual $20.00

GENERAL LEDGER (source code only)

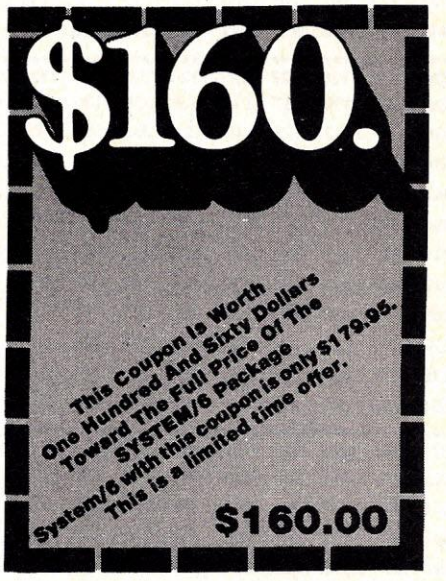
By Osborne. Requires C Basic 2
5" disks $99.95 (manual not included)
8" disks $99.95 (manual not included)
Manual $20.00

C BASIC 2

Required for Osborne software. $99.95/$20.

SYSTEM/6

TPM with utilities, Basic I interpreter, Basic E compiler, Macro I assembler, Debug I debugger, and ZEDIT text editor.
Above purchased separately costs $339.75
Special introductory offer: Only $179.75 with coupon!!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3. Price and method of payment (e.g. C.O.D.) include credit card info. if applicable.
4. Name, Address and Phone number.
5. For TPM orders only: Indicate if for TRS 80, Tarbell, Xitan DDDC, SD Sales (5¼" or 8"), ICOM (5¼" or 8"), North Star (single or double density) or Digital (Micro) Systems.
6. N.J. residents add 5% sales tax.

Manual cost applicable against price of subsequent software purchase in any item except for the Osborne software.

For information and tech queries call
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* TPM is a trademark of Computer Design Labs. It is not CP/M*
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1038	55	272	486	824	424	1318	859	201	1204	645	***	7326
269	491	818	429	1317	860	208	1205	647	1035	47	***	7326
815	421	1314	865	202	1210	646	1036	54	270	493	***	7326
1315	867	199	1202	643	1041	48	275	492	816	428	***	7326
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649	1042	46	274	490	823	419	1312	863	205	1203	***	7326
51	268	495	822	420	1319	864	207	1200	641	1039	***	7326
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427	1310	861	203	1206	642	1045	52	266	494	820	***	7326
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1194	625	1046	113	280	557	774	396	1218	937	186	***	7326
1047	120	281	559	771	388	1215	942	180	1199	624	***	7326
286	558	772	395	1216	944	177	1191	621	1052	114	***	7326
777	389	1221	943	178	1198	622	1054	111	278	555	***	7326
1213	940	183	1192	627	1053	112	285	556	779	386	***	7326
185	1189	619	1050	117	279	561	778	387	1220	941	***	7326
626	1051	119	276	553	775	392	1214	946	184	1190	***	7326
118	277	560	776	394	1211	938	181	1195	620	1056	***	7326
554	781	393	1212	945	182	1197	617	1048	115	282	***	7326

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563	846	402	1285	892	146	1094	700	1027	110	261	***	7326
407	1284	893	153	1095	702	1024	102	258	568	840	***	7326
898	147	1100	701	1025	109	259	570	837	399	1281	***	7326
1092	698	1030	103	264	569	838	406	1282	900	144	***	7326
1032	100	256	566	843	400	1287	899	145	1099	699	***	7326
263	567	845	397	1279	896	150	1093	704	1031	101	***	7326
844	398	1286	897	152	1090	696	1028	106	257	572	***	7326
1280	902	151	1091	703	1029	108	254	564	841	403	***	7326
148	1096	697	1034	107	255	571	842	405	1277	894	***	7326
694	1026	104	260	565	847	404	1278	901	149	1098	***	7326

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165	1163	651	1000	6	339	540	828	379	1294	961	***	7326
656	994	11	338	541	835	380	1296	958	157	1160	***	7326
3	335	546	829	385	1295	959	164	1161	658	991	***	7326
548	826	377	1292	964	158	1166	657	992	10	336	***	7326
384	1293	966	155	1158	654	997	4	341	547	827	***	7326
965	156	1165	655	999	1	333	544	832	378	1298	***	7326
1159	660	998	2	340	545	834	375	1290	962	161	***	7326
995	7	334	550	833	376	1297	963	163	1156	652	***	7326
331	542	830	381	1291	958	162	1157	659	996	9	***	7326
831	383	1288	960	159	1162	653	1001	8	332	549	***	7326
1289	967	160	1164	650	993	5	337	543	836	382	***	7326

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1274	947	135	1171	722	1005	77	294	508	736	457	***	7326
142	1172	724	1002	69	291	513	730	462	1273	948	***	7326
723	1003	76	292	515	727	454	1270	953	136	1177	***	7326
70	297	514	728	461	1271	955	133	1169	720	1008	***	7326
511	733	455	1276	954	134	1176	721	1010	67	289	***	7326
452	1268	951	139	1170	726	1009	68	296	512	735	***	7326
952	141	1167	718	1006	73	290	517	734	453	1275	***	7326
1168	725	1007	75	287	509	731	458	1269	957	140	***	7326
1012	74	288	516	732	460	1266	949	137	1173	719	***	7326
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989	83	361	518	795	412	1239	851	220	1152	706	***	7326
360	519	802	413	1241	848	212	1149	711	983	88	***	7326
796	418	1240	849	219	1150	713	930	80	357	524	***	7326
1237	854	213	1155	712	981	87	358	526	793	410	***	7326
210	1147	709	986	81	363	525	794	417	1238	856	***	7326
710	988	78	355	522	799	411	1243	855	211	1154	***	7326
79	362	523	801	408	1235	852	216	1148	715	987	***	7326
528	800	409	1242	853	218	1145	707	984	84	356	***	7326
414	1236	858	217	1146	714	985	86	353	520	797	***	7326
850	214	1151	708	990	85	354	527	798	416	1233	***	7326
1153	705	982	82	359	521	803	415	1234	857	215	***	7326

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347	504	804	476	1248	920	169	1122	613	1058	65	***	7326
805	483	1249	922	165	1114	610	1063	59	352	503	***	7326
1254	921	167	1121	611	1065	56	344	500	810	477	***	7326
172	1115	616	1064	57	351	501	812	474	1246	918	***	7326
608	1061	62	345	506	811	475	1253	919	174	1112	***	7326
64	342	498	808	480	1247	924	173	1113	615	1062	***	7326
505	809	482	1244	916	170	1118	609	1067	63	343	***	7326
481	1245	923	171	1120	606	1059	60	348	499	814	***	7326

7326	7326	7326	7326	7326	7326	7326	7326	7326	7326	7326		
573	784	467	1228	928	242	1130	673	1022	28	251	***	7326
468	1230	925	234	1127	678	1016	33	250	574	791	***	7326
926	241	1128	680	1013	25	247	579	785	473	1229	***	7326
1133	679	1014	32	248	581	782	465	1226	931	235	***	7326
1019	26	253	580	783	472	1227	933	232	1125	676	***	7326
245	577	788	466	1232	932	233	1132	677	1021	23	***	7326
790	463	1224	929	238	1126	682	1020	24	252	578	***	7326
1231	930	240	1123	674	1017	29	246	583	789	464	***	7326
239	1124	681	1018	31	243	575	786	469	1225	935	***	7326
675	1023	30	244	582	787	471	1222	927	236	1129	***	7326
27	249	576	792	470	1223	934	237	1131	672	1015	***	7326

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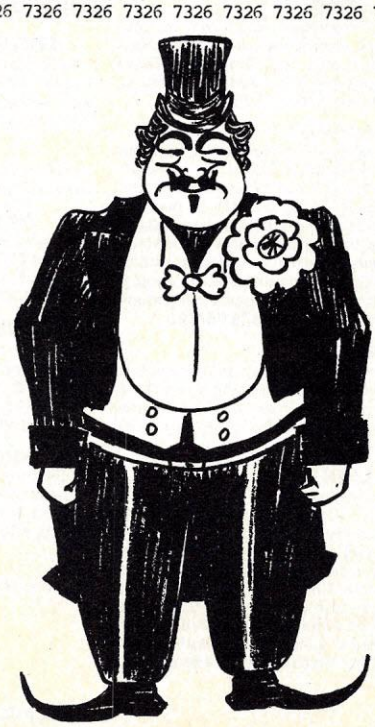

Let us Take you Elsewhen

Designed for use on **PET*** 8K

TREK-X

Welcome to the most sophisticated Trek we've seen yet. We'll beam you aboard to command this mission at the helm of the Federation Starship *Enterprise*. Your briefing follows:
I. The Romulans and the Klingons, normally antagonistic to one another, have decided to form an alliance. This alliance has but one end—to annihilate the United Federation of Planets.
II. You have a dual mission: first, to explore the more distant realms of space; and second, to locate and destroy as many Romulan/Klingon warships as possible. Another ally of the Romulan/Klingon coalition may attack the *Enterprise*—you will receive further instructions.
III. After you make fifty confirmed "kills," your mission will be accomplished, and you can head home.

In Trek-X the vastness of space is depicted by a 12 x 12 x 4 matrix containing suns, planets, moons, and other celestial bodies. Unlike some two-dimensional "treks," Trek-X allows you to move in front of or behind suns, planets, and enemy spacecraft. Note also that quadrant boundaries are transparent to you, just as they would be in real life. You'll have both warp power and sub-light speeds at your disposal, and a detailed map of space will be available on demand. Your ship's computer will display the present alert condition (e.g., Green, Yellow, Red, or CRITICAL), and will keep track of your shield power and the number of hits you've received from enemy vessels.

To add even more realism, optional sound effects—phasor and photon torpedo fire, and their resultant explosions—have been included. Trek-X: more than just a game. For the 8K PET. **Order No. 0032P $7.95.**

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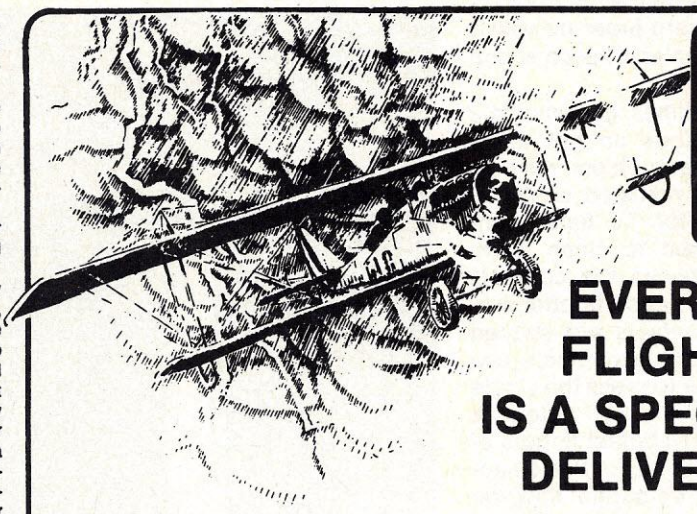

Designed for use on **TRS-80*** 16K LEVEL II

EVERY FLIGHT IS A SPECIAL DELIVERY

OK, Ace, you survived everything that von Richthofen and the Flying Circus threw at you. Well, that was four long years ago—and yesterday's medals don't pay the rent. But just a minute, here's an ad:

"Airmail Pilot wanted . . ."

AIRMAIL PILOT

You can almost smell the gasoline as the ground crew fuels your J-4 Jenny biplane to her 26-gallon limit. Precious mail is loaded into the cargo area, tagged for Chicago. The weatherman reports severe icing above 6,000 feet, so you know you have to keep the plane low. It will be a dangerous flight, but you knew that when you took the job. The mail must go through. So, in the tradition of Lindbergh and a hundred unsung heroes, you bravely turn your plane into the wind. The engine roars. Suddenly you're aloft on the first leg of your journey. Dayton's socked in by fog. You change your course for Lucasville. Lightning zigzags the sky. A massive, fast-moving thunderstorm forces you to land in a cornfield. As the weather clears, your plane leaps once more into the sky. But even clear skies can cause problems—violent air currents buffet your fragile wooden aircraft. Your fuel is down to two gallons as Lucasville comes into sight. You make it! Refuel and head for Chicago. But you're not out of trouble yet. There's a wind shear at the Chicago airport. You have to land in a shifting crosswind. Can you make it? AIRMAIL PILOT from INSTANT SOFTWARE. Unlike any other computer simulation you've ever experienced. Challenging. Difficult. But never impossible. An event in a cassette. Crash or fly, it's so realistic, you can almost feel the wind. Requires a Level II 16K. **Order No. 0106R $7.95.**

Designed for use on **TRS-80*** 16K LEVEL I LEVEL II

SANTA PARAVIA AND FIUMACCIO

The year is A.D. 1400, and you are the ruler of a tiny Italian city-state. You are ambitious by nature and intend to build your little city-state into a powerful kingdom.

So begins Santa Paravia and Fiumaccio, where you and your fellow players compete as rulers of neighboring cities. You control the grain harvest, feed your people, set tax rates, exercise justice, invest in public works and, of course, try to stay on the good side of the church.

Life was short back then, and you'll have only a limited amount of time in which to build your kingdom. The lives of your serfs will depend on your decisions. If you act wisely, then your city-state will grow and you will acquire loftier titles. If your rule is incompetent, your people will starve, and your city-state may be invaded by your neighbors.

You can play the game yourself or set up the tournament version, which allows up to six players at a time to compete. Either way, you're sure to find your route to the throne a challenging and rocky one.

How will you rule your kingdom? Will you be a benevolent ruler—an iron fist in a velvet glove—or will you become unscrupulous and follow the example set by Niccolo Machiavelli in his book on government, *The Prince*? Only *you* can answer that question—with Santa Paravia and Fiumaccio. **Order No. 0043R $7.95.**

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Instant Software Inc. Peterborough, N.H. 03458
603-924-7296

CIRCLE 150 ON READER SERVICE CARD

Debouncing Your TRS-80

Delmer Hinrichs

Do some of the keys on your TRS-80 keyboard put more than one character on the screen when you press them? Annoying, isn't it? But the problem can be easily fixed: Just clean or adjust the key contacts.

This can be done without opening the sealed case. Lift the key caps and the key contacts are exposed. The key caps are easily lifted with a paperclip bent into the shape shown in Photo 1. A firm, steady upward pressure with a little rocking motion and the caps pop right off.

The keys sometimes give multiple entries because they do not make good contact. The problem may be dirt or improperly adjusted contacts. Contact cleaner (for TV tuner contacts) may be used to clean them. Even rubbing between the contacts with the lead of a pencil is effective. Sometimes the contacts are spaced too widely. To adjust the contacts, use a small screwdriver to press the single broad contact (on the left) sideways toward the multiple contact fingers of the other contact. In any of this cleaning or adjustment, be careful that you do not damage the key contacts.

Now just replace the key caps and you are ready to enjoy your TRS-80 again. □

Delmer Hinrichs, 2116 SE 377th Ave., Washougal, WA 98671.

TRS-80 keyboard, with paperclip key lifter and one key cap removed.

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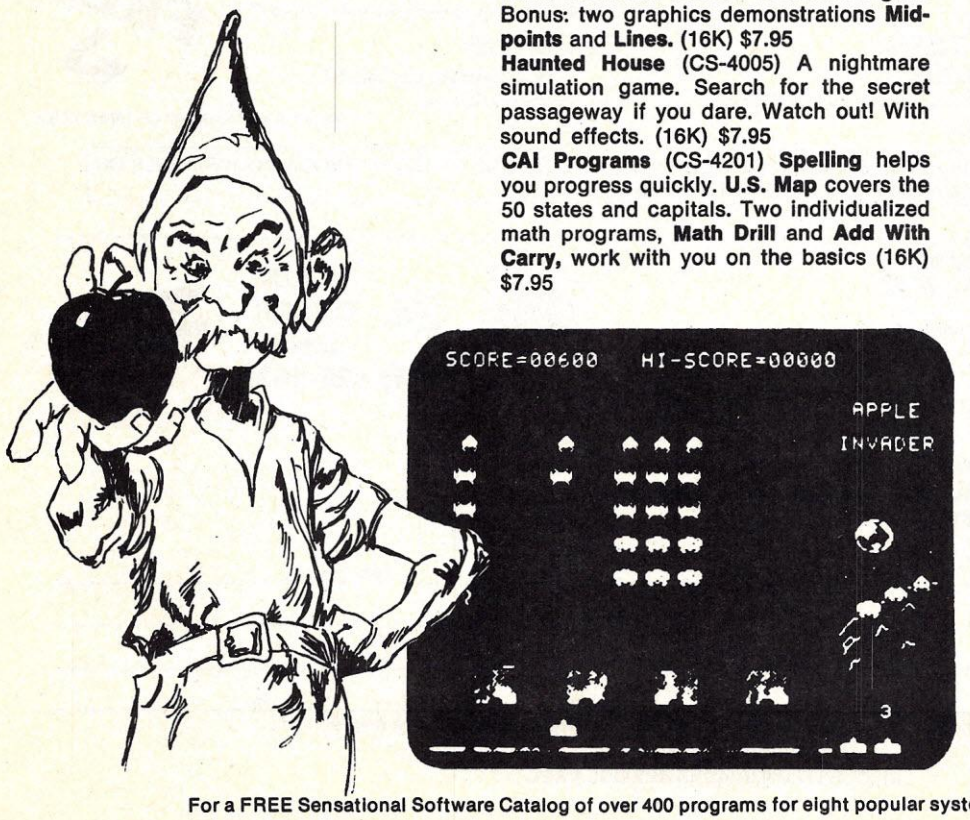

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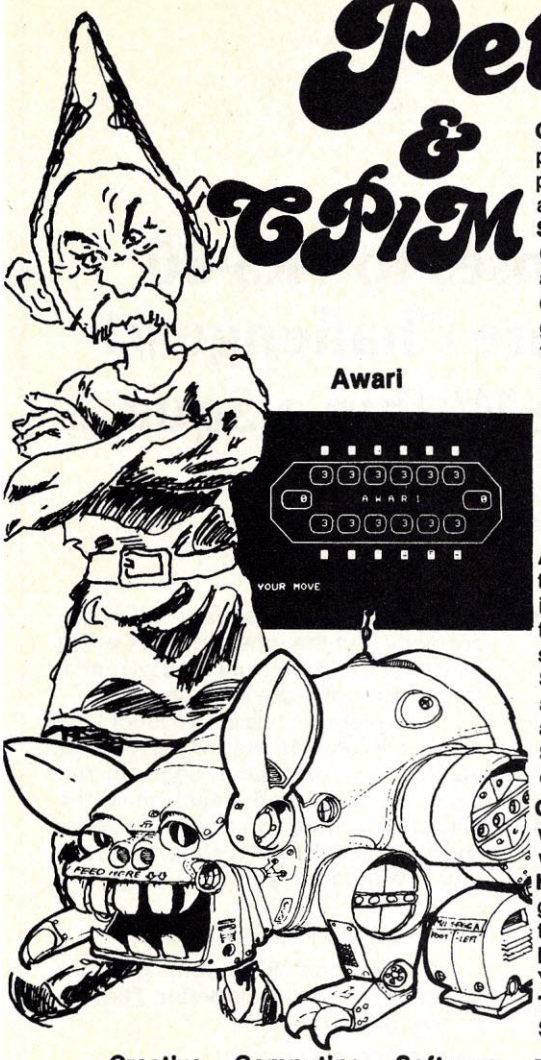

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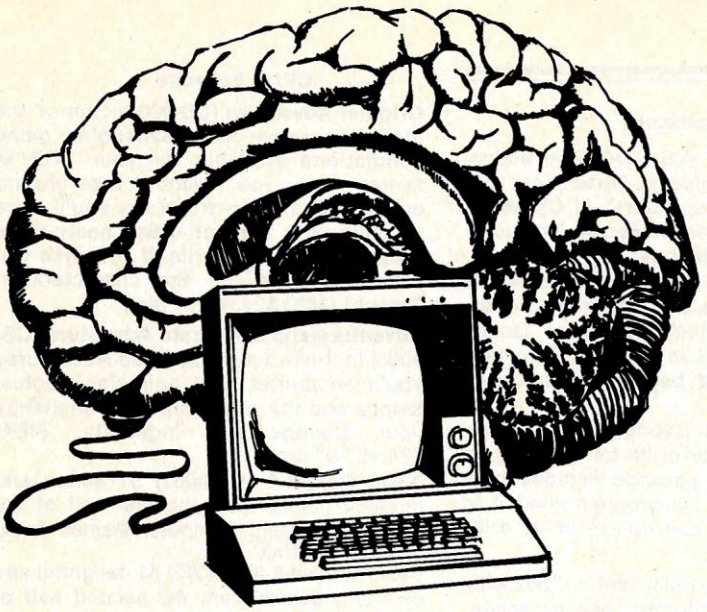


Responses to TRS-80 Software Challenge #1- Square Within a Square

Stephen B. Gray

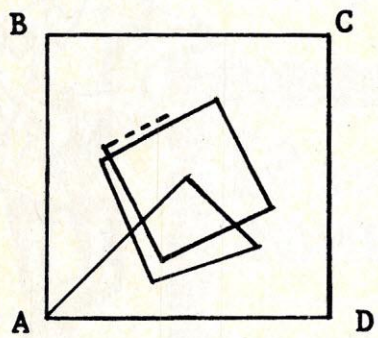
Way back in the September 1979 **Creative** (page 190), the first TRS-80 software challenge was put to you readers. Here's a reprint of most of that challenge:

Software Challenge #1
—Square Within a Square

Think you're a pretty good BASIC programmer? Hot on TRS-80 graphics? Here's a challenge. It's not a contest; there are no prizes, other than the satisfaction of writing a program that leads the TRS-80 through a complex task. Like virtue (or vice), the program is its own reward.

Put a square on the screen, then start running a line from any corner to the opposite corner. But stop halfway across, and then aim at the next corner, clockwise. Again, stop halfway there, and aim at the third corner, clockwise.

That is, start at A, go halfway toward C, then halfway toward D, then halfway toward A, then halfway toward B, etc.



Although the first few lines seem to have no relationship to each other, quite soon the lines begin to trace a square, and from then on will just retrace the square over and over. In theory, that is. But will the lines result in an eternal square in fact?

Writing a program to draw the square ABCD is easy. But can you carry on from there, and draw the "halfway lines?" As an added touch, can you clean up the display by making the early halfway-lines disappear, or even better, fade away? This would eventually result in a display of just the smaller square inside the larger ABCD square.

And for you geometers, can you determine the relationship between the length of a side of the smaller square, and side AB of the larger square? Do it with a pencil and paper first, then check your findings be measuring the lines on the screen.

If you can write this program, and would like to see it printed in this column, please send me a printout of the program, dark enough to be printed on these pages, heavy with REMs or with accompanying documentation, and a short cassette of the program.

Although a couple of readers kept within the bounds of the challenge, most of the small but highly ingenious group that sent in programs, went quite some distance beyond those bounds, and in one case developed a general program for starting with an n-sided polygon instead of a square.

Let's look at five responses to the challenge, ranging from not-so-good to good to excellent.

Truncated Pyramid

The first, from California, was sent by a reader who doesn't have a printer, and who enclosed a handwritten copy of the program, saying "I have not included a cassette copy as the program is rather short if the REMs are deleted."

Perhaps the program on his cassette worked, but the handwritten copy didn't. The outer square is drawn correctly, but the inner polygon isn't a square at all; it's a truncated pyramid. Close, but not close enough.

The program has a nice touch: the inner polygon is traced, and after awhile, after the traces begin to run along the same paths each time, the display is cleared, and reappears showing only the outer square and the four-line inner polygon.

Disintegrating Square

The second, from John Craig of Anaconda, Montana, is better. The first display shows

```
WHAT SHAPE RECTANGLE?
(VERTICAL, HORIZONTAL) ...
MAXIMUM = 48,128
FAIRLY SQUARE = 48,112
```

Note the 3:7 ratio in the "fairly square" values.

The program draws the outer square, then draws the "halfway lines" inside it. As the eighth line starts, the first line begins to disappear, block by block, until only a four-line square is left within the larger square. Can you figure out what's wrong?

However, a slight glitch somewhere in the program causes blocks to drop out here and there, starting around the time the fourth line crosses the first. Can you figure out what's wrong?

Outside of that glitch, the program is fine, and is accompanied by a printout and a detailed and easily understood explanation of the program lines, both shown here. Craig gets maximum points for effort, programming and presentation. (No, this isn't the same John Craig who was editor of **Creative.**)

One small thing: the maximum horizontal value in Craig's first display should be 127, not 128. Although line 8 of his program does subtract one from

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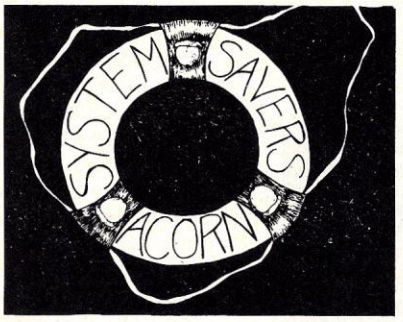

SYSTEM SAVERS

by Tom Stibolt

If you ever use the SYSTEM command, you can use this two program package. These programs allow you to save any system format program on tape or disk, plus offer several features for machine language programmers.

With FLEXL, which is one of the two programs, you can make back-up copies of any system format tape. Most often a cassette that you make will load easier than an original. Plus you can find the filename on any system tape because it is displayed on the screen.

Disk drive owners can use TDISK to save any system format tape on disk. *"Air Raid"*, *"Editor/Assembler"* and other programs cannot normally be loaded to disk. Now TDISK allows you to save these programs onto disk. After DOS READY you will be able to simply type the filename and be up and running. It even loads non-contiguos tapes. TDISK will greatly increase the benefit of owning a disk drive.

Acorn produces several other utility programs for the TRS-80. These include *"Aterm"* and *"Numbering"* by Tom Stibolt; and *"Disassembler"*, *"Tape Utility"* and *"Disk Utility"* by Roy Soltoff. All are available for less than $20.00. Ask for these and other quality Acorn programs at your local computer store.

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Square, cont'd...

the input value of H, line 35 adds back the one in a SET line, and you can't SET a horizontal value of 128. The stated vertical maximum of 48 is OK, because line 8 subtracts one from it, and the one is not added back in later.

In his accompanying letter, Craig says, in part:

"You'll notice several "tricks" in my program that can be quite useful under certain circumstances. So I'll try to explain the operation carefully.

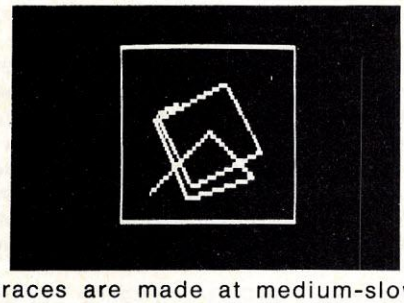
"In several instances you'll notice the use of what I call a "logical variable." The logical comparisons are not limited to IF statements, a fact often misunderstood or overlooked. For instance, in line 120 the value for our step has the quantity (XN<X) in it. If this is evaluated as "true" its value will be -1; if false it returns a value of 0.

"By thinking the equation through, you'll see that the step computes to either +1 or -1, depending on the direction the line will be drawn. Similar use of logical quantities can be found in line 270.

"My first idea when considering how to "remember" previous points in the constructed lines was to use an integer array. However, here I used a technique that oftentimes may be used to save memory space. Each variable in an integer array would require 10 bytes, according to the TRS-80 manual. For remembering 255 X and Y coordinates, we would use over 5K of memory. But by converting the coordinates into characters, we may store all 255 points in two strings, requiring only about 1/10 the memory!"

Straightforward Square

The third, from Robert D. Miller of Hazelwood, Missouri, is the most straightforward of the successful programs. The outer square is drawn, the corners are labeled, the inner



traces are made at medium-slow speed, and after the ninth line is started, the first begins to disappear, block by block.

Miller notes that if a user wants to change the square size, he can do so by changing the boundary values in one of the program lines.

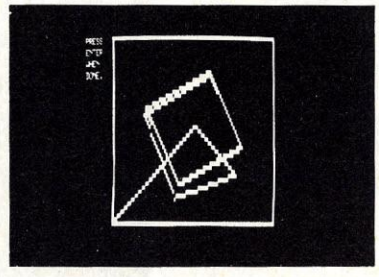
The drawing speed can be changed by lowering the value of IN within another line, "as the loop which sets the points will execute IN times."

Show All Lines?

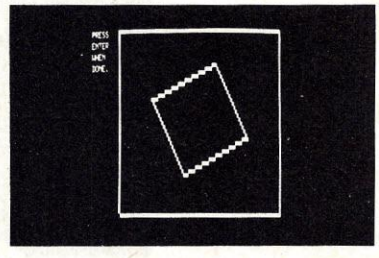
Program number four, from Mark T. Miller of W. Des Moines, Iowa, offers a choice in his first display:

```
WHICH ONE OF THE
FOLLOWING PLEASE:

1 - SHOW ALL LINES THAT
    ARE PRODUCED,
    LETTING THEM REMAIN
    ON THE SCREEN
```



```
2 - ERASE ALL LINES UNTIL
    SQUARE IS DONE
```



```
3 - END

WHICH ONE, PLEASE?
```

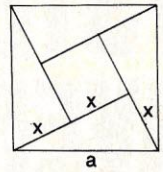
The program contains explanatory remarks, as shown.

In the second choice, "erase all lines," only a line at a time is drawn, and is immediately wiped out, block by block, until the twelfth line, which stays on the screen, along with the later lines.

The program is slightly fudged, to facilitate erasing all lines until a particular one. Several tests could be made to find out what line begins to delineate the final square, such as perhaps testing for a right angle. However, in Miller's program, this wouldn't work, because the final polygon isn't really a square, because the outer rectangle is not a square, but is more like 5⅜ by 6¼ inches in size.

So the author has simplified it all by first finding out that the twelfth line is the one, and then writing line 320 to take care of what might otherwise involve many more program lines.

Miller also enclosed a drawing, saying, "By using the Pythagorean theorem, you can see that the length of the small-square side times 5 is equal to the side of the large square."



$$(2x)^2 + x^2 = a^2$$

$$4x^2 + x^2 = a^2$$

$$5x^2 = a^2$$

$$x^2 = a^2/5$$

$$\boxed{x = a/\sqrt{5}}$$

The fact that the "halfway lines" could just as easily have been "third-of-the-way" or "quarter-of-the-way" lines is something nobody picked up on, perhaps because it's rather obscure. If a "third-of-the-way"

```
 3 CLEAR 3333: CLS
 5 PRINT "WHAT SHAPE RECTANGLE ?  (VERTICAL,HORIZONTAL) ..."
 7 PRINT "MAXIMUM = 48,128    FAIRLY SQUARE = 48,112": INPUT V,H
 8 V=V-1: H=H-1
10 CLS: K=255
20 FOR X=0 TO H: SET(X,0): SET(X,V): NEXT X
30 FOR Y=0 TO V: SET(0,Y): SET(H,Y)
35 SET(1,Y): SET(H+1,Y): NEXT Y
40 X$=STRING$(K,0): Y$=X$
50 X(1)=0: Y(1)=0
60 X(2)=H: Y(2)=0                          LISTing of
70 X(3)=H: Y(3)=V                          John Craig's
80 X(4)=0: Y(4)=V                          program
90 C=2: X=0: Y=V
100 XN=(X(C)+X)/2: YN=(Y(C)+Y)/2
110 M=(YN-Y)/(XN-X)
120 FOR XS= X TO XN STEP 1+2*(XN<X)
130 YS=M*(XS-XN)+YN
140 SET(XS,YS)
150 XR=ASC(RIGHT$(X$,1))
160 YR=ASC(RIGHT$(Y$,1))
170 IF XR*YR>0 THEN RESET(XR,YR)
180 X$=CHR$(XS)+LEFT$(X$,K-1)
190 Y$=CHR$(YS)+LEFT$(Y$,K-1)
200 RS=K+1-RND(RND(RND(K)))
210 XR=ASC(MID$(X$,RS))
220 YR=ASC(MID$(Y$,RS))
230 IF XR*YR>0 THEN RESET(XR,YR)
240 X$=LEFT$(X$,RS-1)+CHR$(0)+RIGHT$(X$,K-RS)
250 Y$=LEFT$(Y$,RS-1)+CHR$(0)+RIGHT$(Y$,K-RS)
260 NEXT XS
270 X=XN: Y=YN: C=C-(C(4)+3*(C=4)
280 GOTO 100
```

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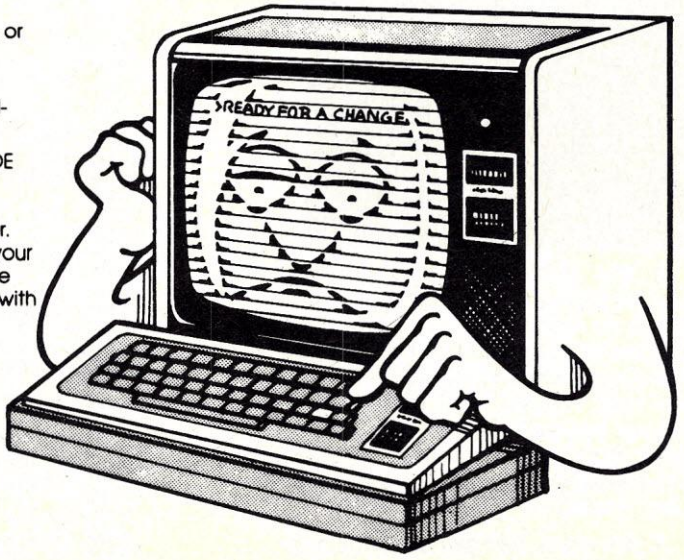

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CIRCLE 117 ON READER SERVICE CARD

Square, cont'd...

scheme had been used, then the number under the square-root sign, as the length of the side of the smaller square, would be 13, and if a "quarter-of-the-way" scheme, then the number would be the square root of 25, or 5.

Want Your Own Polygon?

The winning program is from Thomas Bartkus of Rutherford, New Jersey, who sent in the most complex one. It opens with

```
ENTER X IF YOU WANT
YOUR OWN POLYGON.
JUST HIT ENTER IF
YOU WANT THE SQUARE
```

and then asks

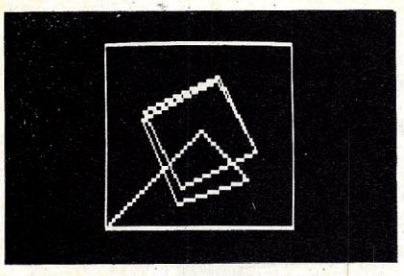
```
DO YOU WANT OLD
LINES TO FADE?
```

If you just want the square, hit ENTER, and if you don't want the old lines to fade, you get a standard display that within 11 lines converges to a set pattern, the square within a square.

If you want the square but decide to let the old lines fade, the first line begins to fade as the fourth one starts. But the fading starts too soon, so that eventually what seems to be a "moving black gap" is in the inner square, with an old line fading away about an inch ahead of the newest line. The effect is of a black worm crawling around the square.

You can choose where you want the square-within-a-square to start, because the display comes up with

```
ENTER COORDINATES OF
STARTING POINT. IF
DESIRED ENTER (7,47).
THIS IS POINT (A)
OF THE SQUARE.
```



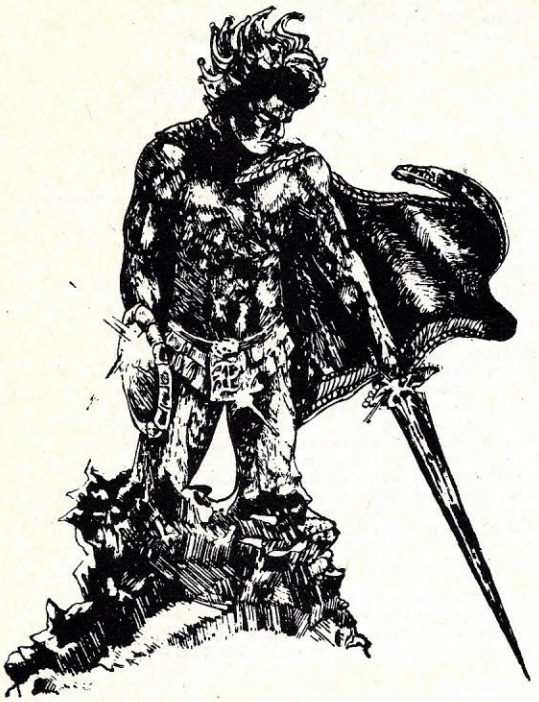
If you don't select the starting point, by default the program selects point B, at the top left. The first line, which starts half an inch to the left of B, surprisingly heads for C, not D. Yet all ends well, within very few traces, finishing up with the required inner square, which is really square because the outer polygon is a real square, 6¼ by 6¼ inches.

If you want your own polygon, the display asks

```
HOW MANY SIDES
IN YOUR POLYGON?
```

```
10 '* SOFTWARE CHALLENGE #1. THOMAS BARTKUS 9/4/79
20 DEFINT C,D,F,I,X,Y :'* SPEEDS COMPUTATION WHERE ALLOWABLE
30 C4=130 :'* LENGTH BETWEEN POINT SET AND RESET
40 DIM X(130),Y(130) :'* STORES LINE POINTS FOR FADE ROUTINE
50 CLS
60 PRINT "ENTER X IF YOU WANT YOUR OWN POLYGON."
70 INPUT "JUST HIT ENTER IF YOU WANT THE SQUARE ";A$
80 PRINT :PRINT "ENTER COORDINATES OF STARTING POINT."
90 PRINT "IF DESIRED ENTER (7,47)."
95 PRINT "THIS IS POINT (A) OF THE SQUARE."
100 INPUT X(0),Y(0)
110 INPUT "DO YOU WANT OLD LINES TO FADE";B$
120 IF A$="X" THEN GOSUB 600 ELSE GOSUB 500 :'* INPUT VERTICES
130 GOSUB 800  :'* DRAW POLYGON
135 IF B$="YES" THEN F1=1 :'* FLAGS FADE ROUTINE
140 GOSUB 900 :'* THE CHALLENGE
195 END
199 '
200 'ROUTINE TO DRAW SOLID LINE BETWEEN X1,Y1 & X2,Y2
210 '-----------------------------------------------
230 DY=Y1-Y2 :DX=X1-X2
240 IF DX=0 THEN 340
250 M=DY/DX :'* SLOPE OF LINE
260 IF ABS(M)>1 THEN 340 :'* IF Y DENSITY >X THEN GOTO Y LOOP
270 I=-SGN(DX) :'* INDICATES LINE DIRECTION
280 FOR X=X1 TO X2 STEP I
290  Y=M*(X-X1)+Y1+.5 :'* EQUATION OF LINE +.5 FOR ROUNDING OFF
300  IF F1=1 THEN GOSUB 1000 :'* GOTO LINE FADE
310  SET(X,Y)
320 NEXT
330 RETURN
340 M=DX/DY :'* SLOPE OF LINE
350 I=-SGN(DY) :'* INDICATES LINE DIRECTION
360 FOR Y=Y1 TO Y2 STEP I
370  X=M*(Y-Y1)+X1+.5 :'* EQUATION OF LINE
380  IF F1=1 THEN GOSUB 1000 :'* GOTO LINE FADE
390  SET(X,Y)
400 NEXT
410 RETURN
420 '
500 ' INPUT VERTICES OF SQUARE
510 ' ------------------------
520 DATA 7,47,7,0,119,0,119,47 :'* VERTICES OF SQUARE
530 FOR C=0 TO 3
540  READ XR(C),YR(C)
550 NEXT
560 C=C-1
570 RETURN
580 '
600 ' INPUT USERS POLYGON
610 ' -------------------
620 PRINT :INPUT "HOW MANY SIDES IN YOUR POLYGON";C
630 IF C<3 THEN PRINT "YOU MUST HAVE AT LEAST 3 SIDES."
635 IF C<3 GOTO 620
640 PRINT :PRINT "ENTER";C;"VERTICES (X,Y) OF POLYGON"
650 PRINT "IN ORDER OF THE LINES TO BE DRAWN."
660 FOR C5=0 TO C-1
670  PRINT "VERTEX #";C5+1;"(X,Y)"; :INPUT XR(C5),YR(C5)
680  IF XR(C5)<0 OR XR(C5)>127 OR YR(C5)<0 OR YR(C5)>47 PRINT
     "POINT MUST BE A VALID TRS-80 SCREEN POINT." : GOTO 670
690 NEXT
700 C=C-1
710 RETURN
720 '
800 ' DRAW THE POLYGON
810 ' ----------------
820 CLS
830 FOR C1=0 TO C
840  X1=XR(C1) :Y1=YR(C1)
850  IF C1=C THEN X2=XR(0) :Y2=YR(0) :GOTO 870
860  X2=XR(C1+1) :Y2=YR(C1+1)
870  GOSUB 200 :'* GOTO LINE DRAWING ROUTINE
880 NEXT
890 RETURN
895 '
900 ' THE SOFTWARE CHALLENGE
910 ' ----------------------
920 X1=X(0) :Y1=Y(0) :'* ASSIGN STARTING POINT
930 C2=2 :'* POINT TO THIRD CORNER TO START (C OF ABCD SQUARE)
940  X2=(X1+XR(C2))/2 :Y2=(Y1+YR(C2))/2 :'* CALCULATE MIDPOINT
950  GOSUB 200 :'* DRAW LINE
960  X1=X2 :Y1=Y2 :'* OLD ENDPOINT IS NEW STARTPOINT
970  IF C2<C THEN C2=C2+1 ELSE C2=0 :'* POINT TO NEXT CORNER
980 GOTO 940 :'* INFINITE LOOP
990 '
1000 ' LINE FADE ROUTINE
1010 ' ------------------
1020 X(C3)=X :Y(C3)=Y :'* STORE SET POINTS IN ARRAY
1030 IF C3=C4 THEN C3=0 :F2=1 :GOTO 1050 :'* F2 TRIGGERS RESET
1040 C3=C3+1
1050 IF F2=1 THEN RESET(X(C3),Y(C3))
1060 RETURN
2000 '*********************************************************
2010 '*  PROGRAM AUTHOR:  THOMAS BARTKUS
2020 '*  28 HIGHLAND CROSS
2030 '*  RUTHERFORD, NEW JERSEY 07070
2040 '*  PHONE: (201)438-1085
2050 '*********************************************************
```

A New Type of Game



Welcome to an astonishing new experience! **ADVENTURE** is one of the most challenging and innovative games available for your personal computer. This is not the average computer game in which you shoot at, chase, or get chased by something, master the game within an hour, and then lose interest. In fact, it may take you more than an hour to score at all, and will probably take days or weeks of playing to get a good score. (There is a provision for saving a game in progress).

The original computer version of Adventure was written by Willie Crowther and Don Woods in Fortran on a PDP-10 at MIT. In this version the player starts near a small wellhouse. Upon entering the house, he finds food, water, a set of keys and a lamp. Armed with only these items, he must set out to explore the countryside in search of treasure and other objects of play. He must also confront dwarfs, snakes, trolls, bears, dragons, birds, and other creatures during his quest. The game accepts one-or two-word commands such as GET LAMP* SOUTH* or KILL DWARF. Of course, if you don't have the proper tool to carry out an action, or if you do something foolish, you may find yourself in big trouble.

In playing the game you wander thru various 'rooms' (locations), manipulating the objects there to try to find 'treasures'. You may have to defeat an exotic wild animal to get one treasure, or figure out how to get another treasure out of a quicksand bog. You communicate thru two-word commands such as 'go west', 'climb tree', 'throw axe', 'look around'.

Adventure

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ORIGINAL ADVENTURE (by Crowther, Woods, Manning and Roichel) - Somewhere nearby is a collosal cave where others have found fortunes in treasures and gold, but some who have entered have never been seen again. You start at a small brick building which is the wellhouse for a large spring. You must try to find your way into the underground caverns where you'll meet a giant clam, nasty little dwarves, and much more. **This Adventure is Bi-Lingual**—you may play in either **English or French**—a language learning tool beyond comparison. Runs in 32K CP/M system (48K required for SAVE GAME feature). Even includes SAM76 language in which to run the game. The troll says "Good Luck."

PIRATE ADVENTURE (by Scott Adams) - "Yo Ho Ho and a bottle of rum..." You'll meet up with the pirate and his daffy bird along with many strange sights as you attempt to go from your London flat to Treasure Island. Can you recover LONG JOHN SILVER's lost treasures? Happy sailing matey.....

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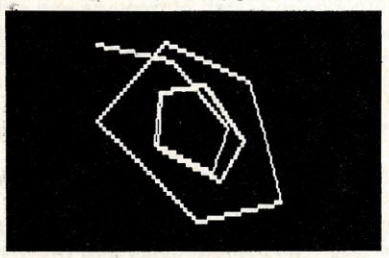
Square, cont'd...

and then asks for details. Let's assume you want five sides and these vertices:

```
ENTER 5 VERTICES (X,Y) OF POLYGON
IN ORDER OF THE LINES TO BE DRAWN.
VERTEX # 1 (X,Y)? 40,0
VERTEX # 2 (X,Y)? 90,10
VERTEX # 3 (X,Y)? 110,40
VERTEX # 4 (X,Y)? 60,45
VERTEX # 5 (X,Y)? 0,20
```

so the program draws the five-sided polygon and then draws a smaller and similar five-sided polygon inside it.



If you want the old lines to fade, they somehow fade faster than they should, and you're eventually left with a little white inch-long bug that crawls around the polygon.

Is the "little white bug" in the polygon version of this program the missing part of the square version, perhaps fitting into the "moving black gap" of the latter?

Actually, no — this is all a tempest in a T-BUG, and the problem can be solved quite simply, by a simple change in the program, as will be shown shortly.

Going from B to C is deliberate, according to Bartkus, who says, "The first entry will be taken as A, the next as B and so on. The program will start by heading toward C, and then the other vertices in order of entry. This means you can trace around a figure either clockwise or counter-clockwise.

"You can start the trace from anywhere on the screen. It makes no difference. Start anywhere on the screen, inside or outside the figure; you always converge on the same path.

"You can opt to leave the entire trace on the screen or choose to have the lines fade. This is a good demonstration that you are locked in on a fixed path. The variable C4, set equal to 130 on line 30, determines how many set points behind the lines start to erase. This value is ideal for a large square, but you may want to reduce or increase it for other figures. If you choose more than 130 points behind, you must increase the DIM statement on line 40 a like amount.

"The heart of the program is a subroutine to draw a solid line from any point to any point. It is a generally useful routine for all graphics work on the TRS-80 and is what made this program easy to write. The whole problem is reduced to the simple task of computing the midpoint between two points.

"The square-within-a-square is indeed a square, centered about the same center (as the external square) but canted 26.6 degrees in a direction opposite to the trace path. The sides of the small square are exactly equal to 1/ 5 the side of the larger square."

Bartkus also notes, "This program contains several features that allow experimentation with this geometrical curiosity. A square can be drawn from memory or the user can opt for any polygon, regular or irregular, of any number of sides, by entering the vertices."

That cant of 26.6 degrees, by the way, is simply arctan (½).

Also, if you raise C4 to 138, you get the full four lines of the inner square. If C4 is 130, the inner square is short by 8 graphics blocks.

The problem of the crawling black or white bug isn't solved by just using a large value for C4, such as 1000. If you use 1000, you're back to displaying only one of the four sides of the inner square. If C4 is 138, or 276, or 414, etc., you get all four sides. Any ideas on why you get the full square only at these multiples of 138?

When starting with a polygon, the completeness of the inner polygon depends on whether C4 is equal to the number of graphics blocks required to draw it. Or does it?

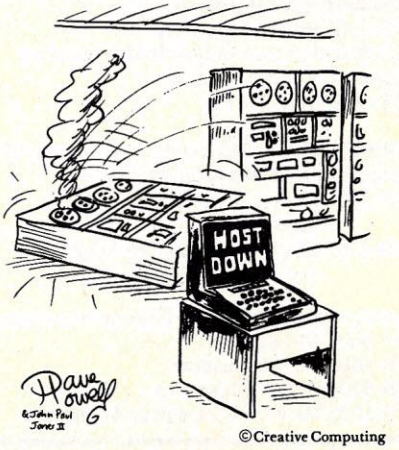
In the case of the polygon illustrated, a C4 of 119 is required to complete the inner five-sided polygon.

The program cassette was not accompanied by a printout or a typed copy; what appears on these pages was taken from the screen.

These give tapes, incidentally, were recorded with a very wide range of volume-control settings and, when played back, required optimum settings all the way from 4 to 10.

Listen in to this same station for responses to the second software challenge. □

```
10 ' ***************************************************
20 ' *****          SQUARE PROBLEM                 *****
30 ' *****          BY: MARK T. MILLER             *****
40 ' *****          W. DES MOINES, IA              *****
50 ' ***************************************************
60 CLS
70 PRINT:PRINT:"WHICH ONE OF THE FOLLOWING PLEASE:"
80 PRINT:PRINT"    1  -  SHOW ALL LINES THAT ARE PRODUCED,
90 PRINT"          LETTING THEM REMAIN ON THE SCREEN"
100 PRINT
110 PRINT"    2  -  ERASE ALL LINES UNTILL THE SQUARE IS DONE
120 PRINT:PRINT"    3  -  END"
130 PRINT:PRINT:INPUT"WHICH ONE, PLEASE";A
140 IF A=3 THEN END
150 DIM X(4),Y(4)
160 CLS
170 PRINT@0,"PRESS":PRINT@64,"ENTER":PRINT@128,"WHEN":PRINT@192,"DONE."
180 X=16:Y=0:X1=112:Y1=0:GOSUB 1000      'THESE LINES
190 X=16:Y=47:X1=112:Y1=47:GOSUB 1000    'MAKE THE
200 X=16:Y=0:X1=16:Y1=47:GOSUB 1000      'SQUARE TO
210 X=112:Y=0:X1=112:Y1=47:GOSUB 1000    'BE USED
220 X(1)=112:Y(1)=0             'STORE THE
230 X(2)=112:Y(2)=47            'CO-ORDINATES
240 X(3)=16:Y(3)=47             'OF THE SQUARE IN
250 X(4)=16:Y(4)=0              'ARRAY X AND Y
260 C=1 'C = COUNTER FOR WHICH VERTICE IS BEING USED
270 X=16:Y=47 'SET BEGINNING POINT
280 FOR I=1 TO 15 'NUMBER OF SEGMENTS TO BE MADE
290 X1=(X+X(C))/2:Y1=(Y+Y(C))/2 'ENDING PT. = MID-PT. OF LINE
300 GOSUB 1000 'CONNECT THE TWO POINTS
310 IF A=1 THEN 330 'LINES SHOULD NOT BE ERASED, SKIP NEXT LINE
320 IF I<12 THEN J=1:GOSUB 1000:J=0 'ERASE LINE MADE
330 X=X1:Y=Y1 'BEGINNING PT. NOW EQUALS THE LAST ENDING PT.
340 C=C+1 'C IS INCREMENTED FOR THE NEXT VERTICE
350 IF C>4 THEN C=C-4 'WHEN THE VERTICE=4 THE NEXT VERTICE=1
360 IF J=1 AND I=7 THEN 380 'FINAL SQUARE SHOULD NOT BE ERASED
370 NEXT I 'NEXT SEGMENT
380 IF INKEY4="" THEN 380 ELSE RUN 'WAIT FOR RESPONSE
390 END
1000 'SUBROUTINE FOR CONNECTING TWO POINTS
1010 ON ERROR GOTO 1110 'IN CASE THE LINE IS VERTICAL
1020 ' X,Y BEGINNING CO-ORDINATES (SUPPLIED BY MAIN PROGRAM)
1030 ' X1,Y1 ENDING CO-ORDINATES (SUPPLIED BY MAIN PROGRAM)
1040 U=Y
1050 FOR T=X TO X1 STEP SGN(X1-X)
1060 IF J=0 THEN SET(T,U) ELSE RESET(T,U)
1070 U=U+SGN(Y1-Y)*ABS((Y1-Y)/(X1-X))
1080 'U IS INCREMENTED OR DECREMENTED HERE
1090 NEXT T
1100 RETURN
1110 FOR U=Y TO Y1 STEP SGN(Y1-Y)
1120 IF J=0 THEN SET(T,U) ELSE RESET(T,U)
1130 NEXT U
1140 RESUME 1100
```



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*Sort timings shown below are nominal times. Times will vary based on sort and system configurations. Nominal times based on Mod I 48K 4-drive configuration, 64 byte records, and 5 sort keys.

TYPE	FILE SIZE (Bytes)	SORT TIME (Sec)	TYPE	FILE SIZE (Bytes)	SORT TIME (Sec)
SORT	16K	33	SORT	340K	1081
SORT	32K	49	SORT	680K	2569
SORT	85K	173	SORT and	85K SORT +	1757
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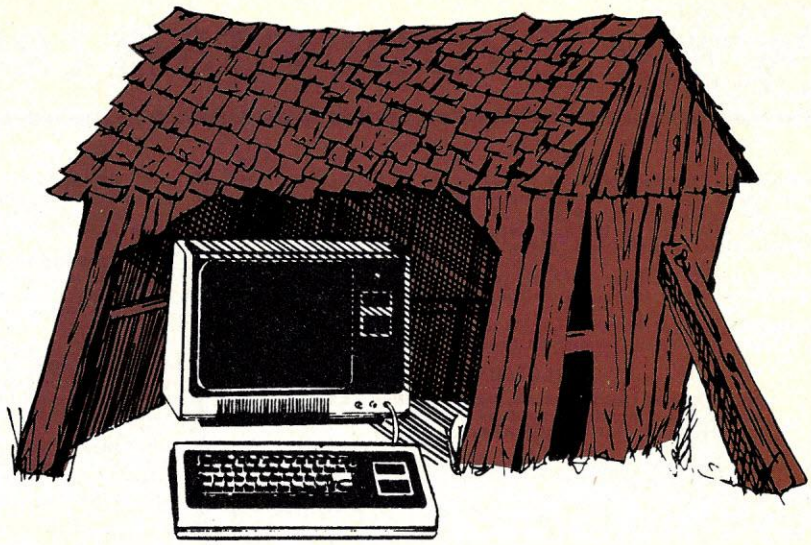


In column 18, we find out how to draw a circle on a TRS-80 screen in three different ways, look at two application programs and two utilities from The Bottom Shelf, check out a random-character generator that does a lot with only four lines, look at two books, one on Learning Level II, the other on Some Common Basic Problems, and check out CSAVE file names.

In between the circles and TBS, you'll find Software Challenge #2, and also in this issue are several of the programs sent in response to the first challenge.

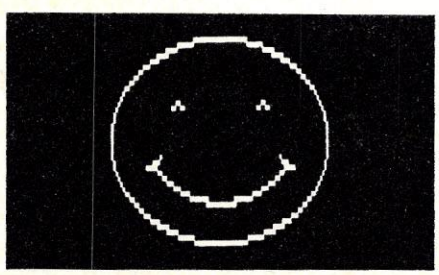
Drawing a Circle

If you want to put a circle on the screen of your TRS-80, there are several ways to do it. You can use a lot of SET statements to turn on graphics blocks exactly where you want to put them.

A much easier way is to use a formula. You insert radius and step-size into the formula, and the computer does all the work of deciding where to put the graphics blocks that constitute the circle. You've got a choice of two basic types of formulas: Cartesian and polar.

Circle With SET Points

A primitive way to draw a circle on a TRS-80 screen is to tell the computer, with SET and FOR/TO/NEXT statements, exactly where to put each graphics block. This is how it's done in the Happy Face program, reviewed in the November 1979 **Creative** (p 180), which draws a round smiling face if you depress the same key as the letter or number shown on the screen, in a learning game.



The major limitation in drawing this kind of circle is that you can't change its size or location without writing those many program lines all over again.

This was no problem for Les Logan, who wanted only to put the same face on the screen for every match between screen and keyboard alphanumerics. He used something like 24 FOR/TO/SET/NEXT statements for groups of contiguous blocks, and 55 SET statements for single blocks, for a total of 212 graphics blocks that go to make a circle just about as smooth as you can get in TRS-80 raster-scan graphics.

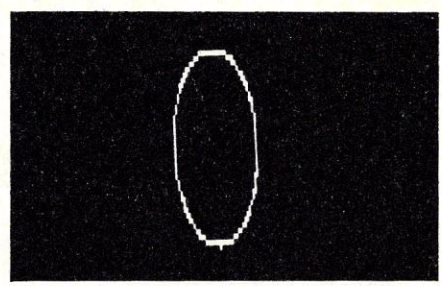
Cartesian-Coordinate Circle

If you had algebra in school, perhaps you remember the equation for a circle, $x^2 + y^2 = r^2$. This has to be transformed so you can use it in a computer program, as in lines 150 and 190:

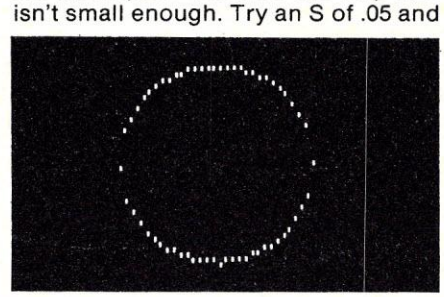
```
100 CLS
110 INPUT "ENTER RADIUS (.5 TO 7.5)";R
120 INPUT "ENTER STEP-SIZE (.01 TO 1)";S
130 CLS
140 FOR X=-R TO R STEP S
150 Y=SQR(R*R-X*X)
160 SET(7*X+64,3*Y+24)
170 NEXT X
180 FOR X=R TO -R STEP -S
190 Y=-SQR(R*R-X*X)
200 SET(7*X+64,3*Y+24)
210 NEXT X
220 GOTO 220
```

This draws two joined half-circles in the center of the screen. If there's a way to do it with a single circle, I couldn't find it.

Note the 7 and 3 multipliers in lines 160 and 200. Remove them and you get an elipse instead of a circle, because the graphics blocks, instead of being square, have an aspect ratio of 3:7. You have to use these numbers as "fudge factors" to create a circle. Of course, you could use just one number, 7/3, or 2.333, for the X factor.



Try keying in the program, RUN it, and enter 6 for radius R (this is not in inches, just arbitrary), and .4 for step-size S. You'll get an incomplete circle, made up of about 60 graphics blocks. It's incomplete because the step-size isn't small enough. Try an S of .05 and you'll get a circle that's almost complete. Try smaller values of S to see how far you have to go to make a complete circle.



Try other values of R and S, and note that as you decrease the value of S, the contiguous groups of blocks start to overlap each other. Notice also that the circle is traced only once around its circumference by the

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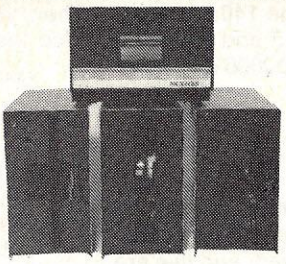

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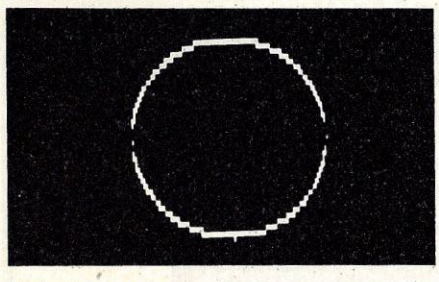
Strings, cont'd...

"moving" graphics block.



Polar-Coordinate Circle

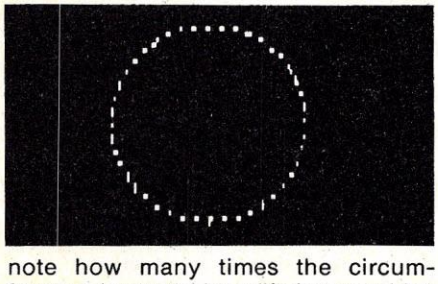
Perhaps in a trig course you got into polar coordinates, and learned how to make a circle using sine and cosine, just as this program does:

```
100 CLS
110 INPUT "ENTER RADIUS (.5 TO 6.5)";R
120 INPUT "ENTER STEP-SIZE (.01 TO 3)";S
130 CLS
140 FOR A=0 TO 100 STEP S
150 B=R*7*SIN(A)+60
160 C=R*3*COS(A)+20
170 SET(B,C)
180 NEXT A
190 GOTO 190
```

Another INPUT line could be added to this program, and to the previous one, to specify location. As written, the circles are placed in the center of the screen.

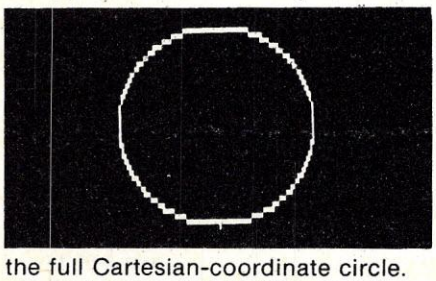
Note that these two programs work only because the SET function includes an INT function (see page 8/1 of the Level-II manual).

Key in this program, RUN it, enter a radius of 6 and step-size of 1, and



note how many times the circumference is traced by a "flying graphics block." Also note how this circle looks different from the incomplete Cartesian-coordinate circle.

However, when you use the same radius and a step-size of .2, the complete circle looks very much like



the full Cartesian-coordinate circle.

For some interesting variations, change line 140 to

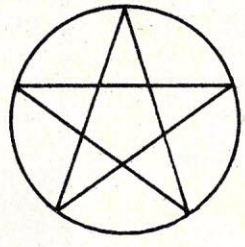
```
140 FOR A=0 TO 500 STEP S
```

and use a radius of 6 and step-sizes of 1, 2, 3 and 4. Then raise the maximum value of A to 1000 in line 140 and try it again. Try a radius of .5 and step-size of .1. Then a radius of .00005 and step-size of 1.

Software Challenge #2 — Star Within a Circle

Quite a variety of responses to the first software challenge (September 1979, p 190) was received, and five are described in this issue.

Now it's time for a second challenge: write a program that puts a circle with a diameter of 2 to 5 inches anywhere on the TRS-80 screen, and then puts a five-pointed star within that circle, just touching it.



Just as several astute readers came up with some clever variations on the first challenge, others will see possibilities in the second challenge that lie beyond the single sentence.

The Bottom Shelf

A fascinating line of application programs and systems utilities is available from The Bottom Shelf, already well known for its "Library 100" offering of 100 programs on five cassettes, reviewed here in April 1979 (p 24). Let's look at two TBS products in each category. All four are for TRS-80 Level-II, 16K and up.

Info System, at $24.50, is a very flexible data-cataloguer that keeps track of almost anything you've got a lot of data on. Such as mailing lists, personnel records, inventory, telephone numbers, books, magazines, etc.

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After asking if you're using the RS-232-C option, the program displays a menu of the ten functions available: Add, Edit, Sort, Search, Video Display, Print, Read Data File, Write Data File, Initialize Data File and End.

To set up the file, enter 9, for Initialize Data File. The display asks you to Enter The Description Of Field #1, then its length. If you're creating a telephone list, using the first field for first name, and you decide ten letters should take care of all the first names, then you enter FIRST NAME and 10, and the display comes p with

```
1   FIRST NAME  ..........
```

which has 10 dots for the field length.

At the bottom of the display are codes for changing the field, deleting it, inputting field 2, or ending the initialization.

After you enter all the fields you need, up to a maximum of 10, the computer tells you how many records can be retained (which, of course, depends on the total length of all your fields), and then asks you to prepare the cassette recorder for recording.

The computer records your initialization data, then you rewind the tape, and input code 7, for Read Data File. After it's read in, you're ready for code 1, Add.

All the field names and lengths are displayed, for you to now enter your records, one by one. When you've entered them all, you can Write Data File, which puts the records on the cassette, or Add, if you want to add more records, or Sort, if you want to sort on any particular field, or Search, or Print, etc.

Field lengths can be up to 40 characters long, with a maximum of 120 characters per record. Printout is programmable in the disk versions.

Checkbook II, for $18.50, keeps your checkbook balanced. If I'd used it a week earlier, it would have saved me an hour's work looking for the error in my checkbook. It's a very comprehensive program, and comes in two versions on each side of the cassette, one for 16K, the other for 32K and up.

The first display is a menu, for Keyboard Input, List And Edit, Print With Balance, Search And Total, Reconcile, Sort, Input From Tape, Output To Tape, Check File Length and Clear.

You start with Keyboard Input, which brings up a five-column display in which you input Check Number, Data, To Whom, Amount and Code. The Code is whatever you choose for identifying the check's purpose, such as RENT, PHON, SUBS, etc.

When you've entered all checks and deposits, you enter 99999 as the check number, to bring back the menu. Now you can List And Edit if anything needs to be corrected. If you want a running balance, code 3 provides Print With Balance, after you've entered your "balance brought forward."

Search and Total lets you examine the data for a check, or group of checks, that have a certain field in common. It then lists those checks and gives a total. Reconcile is the last

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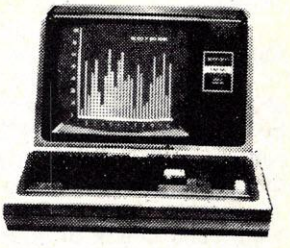

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Strings, cont'd...

operation, in which you enter the balance shown on your bank statement, and the computer tells you if there's an error, and how much, or if your checkbook balances. If it does, the computer deletes all checks except the outstanding ones.

Check File Length tells you how many more checks you can enter. The maximum number of checks for 16K is 75; for 32K, 350, for 32K with DOS, 150. The program handles either disk or cassette files.

Basic Toolkit, at $19.80, is a utility for serious programmers who need the advanced features provided. You load it in memory, via SYSTEM, along with any Basic program you're working on.

You can now search the program and display on the screen an alphabetized listing of all the variables used in the program and the line numbers in which they appear. Or list all the GOTO and GOSUB statements and their line numbers. Or restore the program if you accidentally lose it by typing NEW. Or merge two or more programs. Or search memory for the occurrence of any two-byte pair, and list the locations where it occurs; this is mainly of interest to assembly-language programmers, and those who want to examine the Level-II ROM and TRSDOS.

The utility will also test all the RAM memory for single-bit errors.

You can get into the Basic Toolkit at any time while you're programming, by hitting SHIFT and BREAK. This is a valuable tool if you do any real amount of programming in Basic.

System Doctor, at $28.50, makes a diagnostic check of your whole computer system, and is recommended to anybody who uses a TRS-80 system regularly and often. Two versions are provided, for 16K and for 32K and up.

This utility includes 15 tests, and checks the ROM and RAM to make sure all memory locations are functional, checks the reliability of the disk drives in several ways, checks video memory and video display, checks your cassette recorder(s) for speed, distortion and volume control, and does a 12-hour unattended check of the entire system, with results output to printer, cassette, disk and/or screen.

As an example, my CTR-41 tested as:

```
CASSETTE SPEED IS OFF BY -.46%
ALLOWABLE VARIANCE IS +/-4.0%
```

The last item on the menu is Disk Head Cleaner, for 32K and 48K systems, and requires a "card insert that cleans the head," which you can get free by sending in the card provided.

Each of these four TBS programs comes with two cassette boxes. Only System Doctor has a cassette in the second box (the relay/input/speed test tape). The second box contains three cards: warranty, warranty registration and a certificate that "will provide you with a copy of this program on disk for $10.00."

When you buy any of these programs or utilities in a computer store or Associate Radio Shack store, or get it directly from The Bottom Shelf Inc. (Box 49104-C, Atlanta, GA 30359), it comes wrapped snugly in plastic. Once you open it, you've got a cardboard wraparound, with two cassette boxes and a manual inside, which is not all that convenient to store. Unless you throw away the wraparound and the empty cassette box, that is.

Short Program #9

F. Sutter Fox of McKinleyville, California, sent this for Level-II machines:

"Here's a short program to PEEK into the TRS-80 and print out the character or execute the command therein. Every once in a while some recognizable words pass by — if you load a program and then insert and run this one, even more will come your way!

```
10 CLS
20 FOR A=1 TO 20479
30 PRINT CHR$(PEEK(A));
40 NEXT A
```

For 16K computers, line 20 is FOR A=1 TO 32767."

This program prints short random groupings of letters, numbers and graphics characters, at random locations. They move up the screen rather fast, so you may have to stop the motion with SHIFT @, if and when you see something interesting.

The program also prints error messages now and then, sometimes switches to double-width characters and back, and may even halt with a READY.

As the author seems to suggest, this may be just the thing to slip into a friend's TRS-80 program. Or to put into one of your own, just to watch the effect on others, who will no doubt think your TRS-80 has gone crazy, and who will have a few "recognizable words" to say about that.

Learning Level II

This is the title of the latest book by David H. Lien, who wrote the Level I User's Manual supplied with every TRS-80. The Level II manual supplied with the TRS-80, as users know, is a reference manual written in-house by Radio Shack. Dr. Lien's new book fills in most of the details missing from that book, and can be recommended for either the beginner, or for anybody who wants to know more about areas such as strings, editing, PEEK and POKE, etc.

The 352-page manual is $15.95 from CompuSoft Publishing, Box 19669, San Diego, CA 92119. The first printing of over 10,000 copies sold out in two months.

Some Common Basic Programs?

The 76 programs listed in the Osborne/McGraw-Hill book, "Some Common Basic Programs," by Lon Poole and Mary Borchers, are available on a TRS-80 Level-II cassette.

Although you do get 76 programs for your $15, how often, if ever, will you use them?

The first 20 are financial, including future value of an investment, earned interest table, and term of a loan. The next 26 are mathematical, from the simple (area of a polygon, plot of polar equation) to the complex (linear programming, matrix inversion). Next, 17 statistical programs, including Poisson distribution and chi-square test. The last 11 are a mixture, including tax depreciation schedule, check writer, survey check, day of the week, anglo to metric and alphabetize.

The programs are not without flaws. The day-of-the-week program, when queried as to when New Year's Day occurred this year, gave the day as Monday, when actually it was Tuesday.

Also, some programs require using the book (which is now $12.50, up from $9.50 as of 1-1-80). If you RUN the anglo-to-metric program, you're asked

```
WHICH CONVERSION DO YOU NEED?
```

which means you have to look in the book to find out whether you want conversion 17, which is Fahrenheit to Celsius, or conversion 5, which is miles to kilometers. Why not just add a menu to the program, so the user can pick a conversion from the screen? There's plenty of room on the tape. Half the second side is unused, as is over a third of the first side. Yet each program is recorded only once.

Unless you're a statistician, a mathematician or a banker, only half a dozen of these programs might be of interest. And how often in a lifetime do you need to know the number of days between two dates, or what day of the week January 1, 1984, falls on?

CSAVE File Names

According to page 2/3 of the Level-II Basic Reference Manual, the

Strings, cont'd...

"file-name may be any alphanumeric character other than double-quotes." So first you use the letters of the alphabet, and then the digits 0 through 9.

Although the manual hints at it, you may not have realized that, if you ever need more than 36 file names, you can use the rest of the 64 ASCII characters, except the double-quotes and three others. The first side of the "Some Common Basic Problems" tape contains 44 programs, using file names from # to N, in the sequence shown on page C/2 of the Level-II manual: # $ & ' ( ) * - , - . / 0 1 2 etc.

Although the manual doesn't say so, in a pinch you can also use three of the arrows: up, down and right. But not the left-arrow, which erases the first double-quote if you try to use it as a file name. Nor can you use the space or cursor characters.

So you have 60 different file names at your disposal. □

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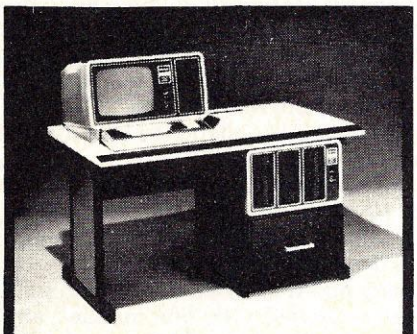

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Personal Electronic Transactions

by Gregory Yob

I am happy to hear from you, and encourage your correspondence. I will try to acknowledge all correspondence, and a SASE makes things easier for both of us. Please send your letters to "Personal Electronic Transactions" c/o PO Box 354, Palo Alto, CA 94301.

A Cry For Help

PET user groups get started in the most unusual places. Ron Schuemann reports that some PETs were left over from an aborted training program in a prison, and some of the electronics shop inmates started playing with them — and now have a small library of programs and several dedicated PET hackers. This fledgling group is desperately in need of information and programs for the PET (Remember that two years ago there was **no** information on PET . . .).

If you are one of those who believe that the personal computer can have some application to the increase of human dignity, please send old magazines or programs that you have tired of to:

Ron Schuemann
c/o Mr. Ed Wood, Supervisor
Computer Programming
Fremont Correctional Facility
Box 999
Canon City, CO 81212

If you sell PET software, this might be considered tax-deductible and could handle some of that "slow" inventory you may have.

Uncle Sam Time Again

As you well know, April is the time for all us fools to take on our government in the attempt to properly compute what's due and to whom. John S. Burtt sent me a 9K program designed to help you compute your taxes if you have a fairly simple "Form 1040" situation. His program asks for 23 items, including exemptions, interest, medical deductions and so on. When all of the items are entered, they are displayed and the computed tax is shown. If income averaging applies, the alternate tax value is also shown. The program will handle single or joint returns, and contains the 1978 and 1979 tax tables.

Once the display is on the screen, the program asks you if you want to change any of the 23 items. This lets you try various "what-if" values to see their effect on your taxes.

If you have an 8K PET, don't despair. Mr. Burtt tells me that one of the tables ('78 or '79) may be removed from the program to make it fit in 8K. I looked at the listing, and it is clear that the program can be "scrunched" considerably. (If you have a friend with a 16K PET, that is!) If you want this program, **write** (don't phone):

John S. Burtt, CPA
2026 Welch Court
Ann Arbor, MI 48103

The DATA Pointers

As you know, the RESTORE statement makes the PET's DATA statements all "new" again — that is, the READ pointer is moved to the start of the Basic program. Sometimes it is nice to be able to re-read some DATA without starting all over. In some Basics, the RESTORE-nnn statement does this — for example, RESTORE 345 will move the DATA pointer to Line 345. Let's see if this can be done for the PET.

The first thing is to take a look at the PET's DATA pointer and see how it changes as DATA items are read. Enter this small program and then RUN it:

```
10 DATA 1,2,3,4,5,6,7,8,9
20 DATA 10,11,12,13,14,15
30 DATA 16,17,18,19,20,21
40 DEF FNX(X)=PEEK(X)+256*PEEK(X+1)
50 PRINT
60 PRINT"DATA POINTER AT:"FNX(144)
70 READ Z:PRINT Z
80 GETA$:IFA$=""THEN 80
90 GOTO 50
```

(If your PET has the "new" ROMs, use FNX(62) in Line 60. The later POKEs to 144 and 145 should be changed to 62 and 63, respectively.)

```
RUN
DATA POINTER AT: 1024
 1

DATA POINTER AT: 1032
 2

DATA POINTER AT: 1034
 3
.... etc ....
```

As you press the SPACE key repeatedly, the data pointer moves along in the Basic program. (For a detailed description of the PET's Basic storage in memory, see the September 1979 column. You will need to know that material to understand the information presented here.)

When the data item moves from 9 to 10 (which will be 10 to 11 on the screen), note how the pointer jumps a bit. We have just moved past a line in Basic, and four bytes are used to hold the line pointer, the line number, and three for the end-of-line zero, the DATA token and the space. Then there are two bytes for the ",9" part of the line. Now pressing SPACE will move the pointer in increments of 3 (,11 then ,12 and so forth).

Now a minor change:

```
85 POKE 144,0:POKE145,4
```

If the program is RUN again, the data item remains at 1 and the pointer is "frozen" at 1024.

This is **wonderful!** To set the DATA pointer, all we have to do is to POKE the pointer to the zero at the end of the preceding line. (Note: A PET Basic line is composed of: 2 bytes to point to the next line in low/high format, 2 bytes for the line number in low/high format, the program text in tokenized form and the value zero. Then a new line begins. The PET's DATA pointer expects to see either a comma or the zero before a line — so location 1024 at the start of all

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PET, cont'd...

Basic programs must be a zero. If you are a hacker, zero is the 6502 BRK instruction, and that's how SYS 1024 starts the Monitor in "new" ROM versions of the PET.)

A few changes and additions to our program does the trick:

```
Lines 10-40 - remain the same
50 PRINT "WHICH LINE TO START DATA AT?"
60 INPUT LD
70 GOSUB 1000
80 READ Z: PRINT Z
90 PRINT"PRESS KEY TO GO ON"
100 GET A$:IFA$=""THEN 100
110 GOTO 50

1000 REM GIVEN LD, POKE THE DATA POINTER
1010 REM TO SIMULATE RESTORE-NNN FOR LINE LD
1020 REM REQUIRES DEF FNX(X)=PEEK(X)+
     256*PEEK(X+1) PRIOR TO THIS ROUTINE
1030 LP=1025
1040 LN=FNX(LP+2)
1050 IF FNX(LP)=0 THEN PRINT"LINE NUMBER
     TOO LARGE":END
1060 IF LN>=LD THEN 1100
1070 LP=FNX(LP)
1080 GOTO 1040
1100 LP=LP-1
1110 PA=INT(LP/256)
1120 PB=LP-PA*256
1130 POKE 144,PB: POKE 145,PA
1140 RETURN
```

If you RUN this program, you will see that the value for Z will correspond to the first item of the DATA statement you specify in response to the question in Line 50.

If you just want to use this program, copy the routine at 1000 as required and feed it the value LD for the line you want to RESTORE to.

The explanation of Routine 1000 goes like this: Line 1030 sets the line pointer LP to the first pointer in the Basic program, which is at location 1025. Line 1040 computes the line number. (If you want to watch the search as Routine 1000 runs, insert: 1045 PRINT LP,LN.)

The last line in a Basic program will have a pointer pointing to a null pointer whose value is zero. The next pointer is given by FNX(LP), so this is checked for the end of the program. Line 1050 takes care of this.

Line 1060 checks for the line to restore to. The routine is forgiving in that if LD doesn't match the line number, the next largest line number is used. You can change this by using = instead of >=. Line 1070 moves LP to the next line, and we repeat to look further.

Line 1100 uses the fact that the DATA pointer is to be positioned just before the line of interest — where there is always a handy zero. (Failure to do this gives you a ?SYNTAX ERROR when the READ is attempted.) Lines 1110 and 1120 compute the High/Low values, and Line 1130 does the dirty deed. "New" PETs should use 62 and 63 here.) Now we are done.

If you try the program out, you will get ?OUT OF DATA ERROR IN . . . for lines over 30 — a moment's thought will tell you this is correct, for there isn't any data after Line 30. If you try some line like 2000, Routine 1000 will complain. (You don't really want the DATA pointer off into Outer Space anyway.)

Let me know if this program is of any use . . .

HANGMATH — A Lesson in Program Modification

Jack Rossum sent me a program, HANGMATH, and asked for my comments. As with many programs, a lot of work remained to be done if the program were to be distributed commercially. Since many of you out there have a program or two which could be transformed into commercial software, here is a step-by-step "case study" of how this might be done.

For starters, I asked Jack if the program idea was originally his. The original version of HANGMATH appeared in the April 1977 issue of Kilobaud Microcomputing, page 112. I feel it is important to know the original author's name and to include it in any modified versions. (Some of you may have played a game called Wumpus — do you know who originally wrote it?)

The next step was to play the game and see how I felt about it. A listing of the original version is shown below:

```
4 REM BY J.R. ROSSUM(MAY 2 1979)
10 PRINT"clr":INPUT"DO YOU WANT INSTRUCTIONS"
    ;A$
20 IF LEFT$(A$,1)="N"THEN 80
30 PRINT"clr sp sp sp THE DISPLAY REPRESENTS
    THE MULTIPLIC-ATION OF A THREE";
40 PRINT "DIGIT NUMBER BY A TWO sp sp
    DIGIT NUMBER.EACH LETTER REPRESENTS A sp";
50 PRINT "sp sp DIGIT. THE OBJECT IS TO
    GUESS THE VALUE OF EACH LETTER IN
    THE sp";
60 PRINT"IN THE FEWEST sp sp sp sp sp TRIES."
65 PRINT"FOR A LIST OF YOUR GUESS'S TYPE
         'L,Ø'. sp sp sp sp sp sp sp sp
        NOW,WAIT FOR DISPLAY"
70 U=Ø:T=Ø
80 DIM U(16)
90 DIM N(4),A(4,5),B(4,5),C(4,5),E$(4,5),
    V(12,10)
92 FOR A=ØTO12:FORB=ØTO10:V(A,B)=Ø:K(B)=-1:
    Q$(B)="":NEXT:NEXT
100 W=Ø:F$="":R1=RND(-TI)
110 C$="ABCDEFGHIJ"
120 R=INT(LEN(C$)*RND(1)+1)
125 N$=MID$(C$,R,1):F$=F$+N$
130 IF R>1 THEN T$=LEFT$(C$,R-1):GOTO 150
140 T$=""
150 C$=T$+MID$(C$,R+1)
160 IF LEN(C$)>Ø THEN 120
162 PRINT:PRINT
170 IF LEN(F$)<>10 THEN 100
180 PRINT:PRINT
210 N(Ø)=100+INT(900*RND(1))
220 N(1)=10+INT(90*RND(1))
230 N(2)=N(Ø)*(N(1)-10*INT(N(1)/10))
240 N(3)=N(Ø)*INT(N(1)/10)
250 N(4)=N(Ø)*N(1)
260 FOR X=Ø TO 4:C=Ø:FOR Y=1 TO 5
270 A(X,Y)=INT(N(X)/INT(10↑(5-Y)))
272 B(X,Y)=A(X,Y-1)
274 C(X,Y)=A(X,Y)-10*B(X,Y):
    E$(X,Y)=MID$(F$,C(X,Y)+1,1):C=C+C(X,Y)
280 IF C=Ø THEN E$(X,Y)=""
290 NEXT:L(X)=LEN(STR$(N(X))):NEXT
300 PRINT
400 FOR X=Ø TO 4: FOR Y=1 TO 5
402 T=20
404 IF X=3 THEN T=18
410 PRINT TAB(T-L(X));E$(X,Y) ;"SP";
420 NEXT:IF X=1 OR X=3 THEN PRINT:
    PRINT;TAB(13);" E E E E E E E E E E"
      (ten SHIFT-E)
430 PRINT:NEXT:PRINT

500 INPUT"LETTER,NUMBER";Z$,N
502 IFN=K(N)THENPRINT:PRINTTAB(15)
    MID$(F$,N+1,1);"sp ="N;
    ",DUMBO":PRINT:GOTO500
504 IF Z$=Q$(N) THEN PRINT:PRINT "YOU
    GUESSED THAT BEFORE":PRINT:GOTO500
512 IF Z=76 THEN 534
514 V(Z-65,N)=16*Z+N+1
520 IF Z$=MID$(F$,N+1,1) THEN 600
530 PRINT "NUMBER WRONG IS"W+1:
    W=W+1:Q$(N)=Z$
532 GOTO 500
534 GOSUB 800

600 N1=50:FOR X=Ø TO 4:FOR Y=1 TO 5
610 IF E$(X,Y)=Z$ THEN E$(X,Y)="lft"
    +STR$(N):K(N)=N
620 IF E$(X,Y)="" THEN 680
630 M=ASC(E$(X,Y))
632 IF M=157 THEN M=Ø
640 IF M>N1 THEN N1=M
680 NEXTY: NEXTX
682 IF N1<60 THEN 700
690 PRINT: GOTO 400
700 PRINT:PRINT TAB(15)"**********"
    :PRINT:PRINT TAB(15);"YOU HAVE IT"
710 PRINT:PRINT TAB(13);"NUMBER WRONG="W
720 T1=T1+W:U=U+1:T2=T2+W*W
730 PRINT:PRINTTAB(10)"AVERAGE AFTER"U
    "GAMES IS"T1/U
740 PRINT:IF U>1 THEN PRINT "STD.DEV="
    SQR((T2-T1*T1/U)/(U-1))
750 PRINT:PRINT:INPUT"sp sp sp sp sp sp
     ANOTHER GAME";B$
760 IF LEFT$(B$,1)="Y" THEN 92
770 END

800 FOR K=0 TO 9:PRINT CHR$(65+K);
    :FOR P=Ø TO 10
810 X1=INT(V(K,P)/16):Y1=V(K,P)-16*X1
820 IF Y1-1=P THEN 828
824 PRINT "sp sp sp";
826 GOTO 830
828 PRINT Y1-1;
830 NEXT:PRINT:NEXT:PRINT
840 RETURN
```

(Note: For this column I have typed numerous programs which I have written. It was quite a surprise to find how difficult it is to type a program written by someone else — whose style is very different from mine!)

If you really want to "feel" this program, be sure to enter it and play a few rounds. Then my comments will make more sense. Several complaints immediately appeared:

1) No title page.

2) The program is not "input-proof." A RETURN will kill the program.

3) The instructions are exceedingly terse and hard to read. There is even a typographical error. The "Press Key To Continue" convention isn't followed.

4) The screen scrolls up as you enter most guesses. Only a correct guess will restore the display.

5) The entry of a guess is somewhat clumsy.

A close look at the program's code is yet another revelation. My first inclination is to entirely redo the program from scratch — but that isn't very instructive. If you are a professional programmer, the situation of modification of another's code is very common — and very frustrating.

The code is obviously much-

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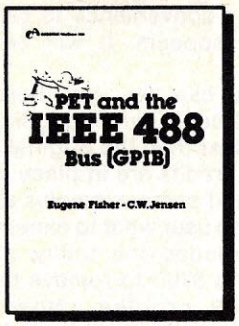

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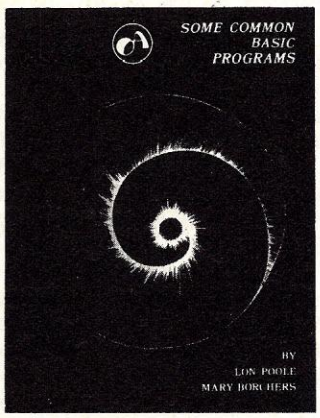

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PET, cont'd...

modified as the unusual line numbers indicate. There are no comments, so changing the program will be the solution of a puzzle as well. Several programmer's short-cuts can be applied, for example, PRINT"dn" to replace PRINT:PRINT can be used in 10 different places.

First things first — let's clean up the instructions and provide a title page for all of the credits. If you look at Lines 30 to 65, the PRINT statements are all "stuck together" — if you change Line 30, Lines 40 and 50 will also be influenced. My own preference is one line of display per PRINT statement to make editing simple. Here are the changes for title and instructions:

```
Lines 4 through 65 - delete
10 REM HANGMATH PROGRAM
20 REM SEE TITLE PAGE FOR CREDITS
30 GOSUB 1000
40 GOSUB 2000
50 GOTO 50

1000 REM TITLE PAGE
1010 PRINT"clr HANGMATH
1020 PRINT"dn dn ORIGINAL AUTHORS:
1030 PRINT"dn sp sp PHIL FELDMAN
1040 PRINT"sp sp TOM RUGG
1050 PRINT"sp sp (APRIL 1977 KILOBAUD,
     PG 112)
1060 PRINT"dn dn MODIFICATIONS BY:
1070 PRINT"dn sp sp J. R. ROSSUM
1080 PRINT"dn dn MORE CHANGES BY:
1090 PRINT"dn sp sp GREGORY YOB
1100 RETURN
2000 REM INSTRUCTIONS
2010 PRINT"dn dn dn INSTRUCTIONS? sp";
2020 GOSUB 3000
2030 IF A$<> "Y" THEN RETURN
2040 PRINT"clr HANGMATH -INSTRUCTIONS-
2050 PRINT"dn dn sp sp HANGMATH WILL
     PRESENT YOU WITH A
2060 PRINT"MULTIPLICATION PROBLEM WHICH
     HAS THE
2070 PRINT"DIGITS REPLACED BY LETTERS.
2080 PRINT"dn dn FOR EXAMPLE:dn"
2090 PRINT"      A B F          4 5 6
2100 PRINT"    X   E D        X   3 2
2110 PRINT"    -------        -------
2120 PRINT"      H C D          9 1 2
2130 PRINT"  C E F I          1 3 6 8
2140 PRINT"  -----------      -------
2150 PRINT"  C A B H D        1 4 5 9 2
2160 PRINT"dn dn sp sp HERE THE LETTER
     'A' IS THE DIGIT 4
2170 PRINT"THE LETTER 'H' IS THE DIGIT
     9 AND SO
2180 PRINT"ON.
2190 GOSUB 3100
2200 PRINT"clr -MORE INSTRUCTIONS-
2210 PRINT"dn dn TO ENTER A GUESS, JUST
     TYPE THE
2220 PRINT"LETTER AND NUMBER. FOR EXAMPLE,
     'A4'
2230 PRINT"AND '4A' WILL BOTH WORK FOR
     MATCHING
2240 PRINT"THE LETTER 'A' WITH THE DIGIT
     '4'.
2250 PRINT"dn sp sp IF YOU ENTER 'Q' THE
     SOLUTION WILL
2260 PRINT"APPEAR.
2270 GOSUB 3100
2280 RETURN

3000 REM INPUT ONE CHAR
3010 PRINT"rvs V lft";:FORJ=1TO100:NEXT
3020 PRINT"off sp lft";:FORJ=1TO50:NEXT
3030 GETA$:IFA$=""THEN3010
3040 RETURN

3100 PRINT"dn dn PRESS ANY KEY TO CONTINUE";
3110 GOSUB 3000: RETURN
```

Note that lines 2090 to 2150 do not include the spaces as 'sp.' It is more important to see how the display appears on the screen. Assume each blank in these lines is to be entered.

The character used in 2110 and 2140 is SHIFT-@. The 50 GOTO 50 is simply a convenience to see how the display appears. It will be removed later.

You can see that these instructions, though much longer, are much more clear than the original ones. The proper credits are in place on the title page, and some examples are present to tell the user what to expect. We have also included the utility routines at 3000 and 3100 to remove the INPUT/RETURN problem. Now a single keypress will take care of Y/N and other simple inputs.

A more subtle feature is the removal of A,1 by A1 or 1A when entering guesses. Since this isn't done yet, let's go ahead and do it! (Of course I had to keep this in mind while rewriting the instructions.)

```
500 GOSUB 3200: IF F THEN PRINT "QUIT":END
50 (delete)
70 U=0:T=0:PRINT"clr SETTING UP ....
400 PRINT"clr":FOR X=0 TO 4: FOR Y=1 TO 5

3200 REM GUESS ENTRY
3210 REM GET 2 CHARS
3215 PRINT"dn
3220 F=0:Z$="@":N=-1
3230 PRINT"YOUR GUESS: sp";
3240 FOR K=1 TO 2
3250 GOSUB 3000:PRINTA$;
3260 IF A$="Q" THEN F=1:RETURN
3270 REM FORM Z$,N
3280 IF A$>"@" THEN Z$=A$: GOTO 3300
3290 N=ASC(A$)-48
3300 NEXT K
3310 REM CHECK FOR VALID
3320 IF N<0 OR N>9 THEN 3350
3330 IF Z$<"A" OR Z$> "J" THEN 3350
3340 PRINT: RETURN
3350 PRINT:PRINT"up BAD LETTER OR NUMBER"
3360 FOR J=1 TO 500: NEXT
3370 PRINT"up 21 spaces"
3380 PRINT"up";:GOTO 3220
```

Line 500 was the original INPUT statement for Z$ and N. A GOSUB to the guess entry routine was put here instead. The test for F is to see if the "Q" option was used. For the present, a simple report is inserted, and later a jump to the solved problem will go here.

Line 70 is a nicety — HANGMATH takes some time to set up a problem, so the screen is cleared and the user told about it. Rather than scrolling the problem each time it is written, the screen is cleared in Line 400.

Routine 3200 fetches the guess and converts it into the expected Z$ and N. A few tricks are used to insure that the correct values for Z$ and N are entered, and to report errors without more scrolling of the screen. Line 3220 sets Z$ and N to illegal values — after all, the player might enter 'AA' instead of A1. Line 3250 gets the letter in A$, and Lines 3280 and 3290 try to convert A$ to Z$ or N.

In 3310, N and Z$ are checked for 0-9 and A-J, the legal values. An illegal value causes the BAD LETTER OR NUMBER to be written over the YOUR GUESS for a short while (Line 3360 to adjust that, you might use 1000 for children) and then an entry is attempted again. By careful use of Cursor-UP, the lines don't scroll. Note the "erase" Line 3370 to clear the error message.

If you now try the new HANGMATH, a fair improvement is seen. The screen still scrolls due to some of the messages, and the L,0 will no longer work — but a nicer appearance is already evident. Now to attack these details:

```
70 U=0:T=0
91 PRINT"clr SETTING UP ..."
400 PRINT"hm HANGMATH sp sp sp sp sp sp sp";
402 FOR X=0 TO 4: FOR Y=1 TO 5:T=20
502 IF N=K(N) THEN M$=MID$(F$,N+1,1)+
     "sp ="+STR$(N)+", sp DUMBO":
     GOSUB3500:GOTO 500
504 IF Z$=Q$(N) THEN M$="YOU GUESSED THAT
     BEFORE":GOSUB3500:GOTO 500
530 W=W+1:M$="*** MISSED *** YOU ARE DOWN
     "+STR$(W):Q$(N)=Z$:GOSUB3500
532 GOTO 500
420 NEXT:IFX=1 OR X=3 THEN PRINT:PRINT
     TAB(13)" @ @ @ @ @ @ @ @ @ @ @ up"
710 PRINT:PRINT TAB(T);"YOU WENT DOWN"W
730 PRINT:PRINTTAB(7)"AVERAGE AFTER"U
    "GAMES IS"T1/U
740 (delete this line)
750 PRINT"dn dn ANOTHER GAME? sp";:GOSUB3000
760 IF A$="Y" THEN 91

3500 REM TEMP MESSAGES DISPLAY
3510 REM USING M$
3520 PRINT"dn dn"M$
3530 FOR J=1 TO 2000:NEXT
3540 PRINT "up          39 spaces      "
3550 PRINT" up up up up up up up"
3560 RETURN
```

Most of this is simply "clean-up" work. Line 91 is inserted to do the function of the SETTING UP . . . which was previously in Line 70. This is a consequence of Line 760 which has to avoid the DIMs in 80 and 90. Line 400 is arranged to print the program name and to obliterate the end of the SETTING UP . . . message which is still on the screen. We use Home Cursor here to avoid blinking the display while it is re-drawn. Lines 502, 504 and 530 use a new routine, 3500, which displays a message briefly and then erases it. This keeps the screen neat. Line 420 cleans up the display of the problem to match the examples in the instructions. Lines 710 to 740 change the end-of-game display a little. I can't see that the standard deviation will help a HANGMATH player. Line 750 makes use of the utility routine 3000.

This completes the "cosmetics" for HANGMATH. There are still some annoyances:

1) If an all-zero line appears in the multiplication, it will be printed as blanks.

2) There's room for the past guesses report on the screen.

3) If this game is to be called HANGMATH, the HANGMAN theme should be used.

4) The Quit option isn't implemented.

PET, cont'd...

I shall leave these final tasks up to you (send me your tape if you do anything on these), with a few suggestions on how to proceed.

First, N(1) is the lower multiplier (see Line 250). To remove the zeroes problem, just force N(1) to **not** be an even multiple of 10. For example, 255 IF 10*INT(N(1)/10)=N(1) THEN 250 should do the trick.

Subroutine 800 provides a clumsy "past guesses" report. This could be printed on the screen below the area reserved for the messages after entry of guesses. (That's 4 lines below the YOUR GUESS: line) Warning! At the end of the game the game report will write onto the same space, so some changes in the 700 area are in order.

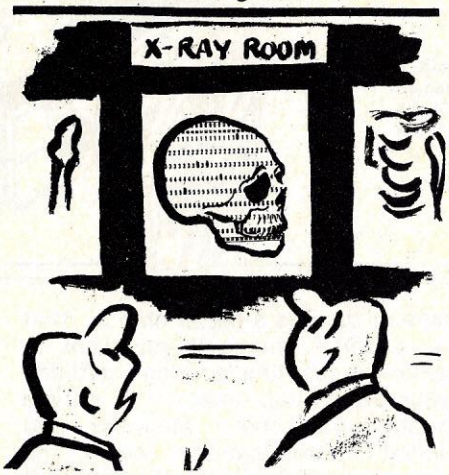
Line 530 keeps track of the misses. A GOSUB 4000 could be used to keep track of the mistakes and provide a M$ suitable for each miss. For example,
W=1 gives YOU LOST YOUR HAND
W=2 gives YOU LOST YOUR OTHER HAND
and so on. W=12 to lose the game . . .

One last thing . . . there's still a bug in HANGMATH. If your first guess for a letter, such as C, was successful, further guesses for C will not evoke the DUMBO message, (i.e., if you got C8 successfully, tried C7 previously, but hadn't assigned letters for 4,5 and 6, HANGMATH will give you a *** MISSED *** for C4, C5 and C6. The correct response is the DUMBO message.)

I hope this helps you with future programs. It all comes down to two major points:

A. The screen display must be neat and clear.

B. The user's input must be foolproof, simple and appropriate to the current level of the game. □



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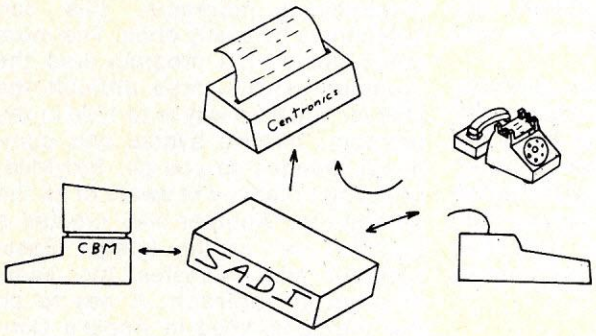

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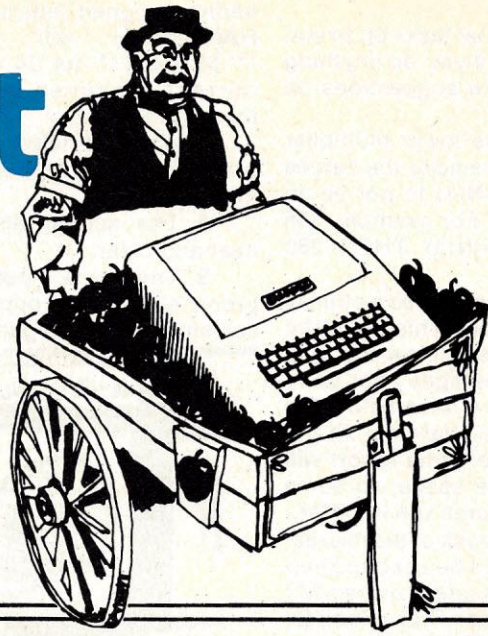

Chuck Carpenter

Correspondence is always welcome and a response will be made to those accompanied by a SASE. Send your letters to: Chuck Carpenter, 2228 Montclair Pl., Carrollton, TX 75006.

Apple II vs Apple II Plus

Confusion over the advantages and disadvantages of the two basic models of the Apple II has created problems for some buyers. The Apple II plus has been advertised as an "Improvement" of the Apple II. Whether or not there has been any real improvement, is a matter of opinion. Here's a summary of some of the features:

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- Number range ±32767
- Whole number (integers) only
- Fast speed
- Direct assembly language access
- Sweet 16 interpreter
- Floating point assembly language routines
- Limited string functions for text

Apple II plus

- Applesoft Basic - standard
- Autostart ROM
- Floating point (decimal) numbers
- Number range ±9.99999999 E37
- Expanded string functions
- Extended programming commands

The significant difference is that you can't run Basic programs written for one on the other. And conversion from one to the other is not a simple task either. More on that later.

By adding a $200.00 language card to either unit, you can include all the features in one machine. Considering that most currently available software is written in Integer Basic, it appears that the Apple II with Applesoft in RAM (on tape or disk) is a better choice. That is, a better choice if you want to avoid the cost of a language card and your computing interest is only a hobby. For some business and scientific applications where the extended capabilities of Applesoft are needed, the Apple II plus is a better choice.

If you're interested in becoming familiar with and using assembly language, then buy the Apple II. The Apple II plus with autostart eliminates most of the useful assembly language capability. Of course, the use of assembly language is often an area of confusion for the newcomer. Assembly language programs are used frequently in parts of other programs and as complete operating systems. As you become more and more familiar with the capabilities of the Apple, the mysteries disappear. Don't limit your possibilities. Remember: everything is easy once you understand it.

One more point. Most computer retailers are selling both versions for the same price. There is really no difference in the hardware you get; just the language implemented in the basic machine. Have a serious talk with the store people (or buy elsewhere) if you're charged more for an Apple II plus.

Integer Basic Card

If you want to have all the features of both versions of the Apple, then get the Apple II plus with the Integer Basic cards. There are some advantages to doing this too—the Programmers Aid ROM is included. In addition to getting all the assembly language capability, you have all the useful features of the programmers aid ROM. For instance:

- Renumber and Append (Integer Basic)
- Tape verify (Basic)
- Tape verify (binary)
- Relocate (binary)
- RAM test program
- Music routines
- High Res graphics routines

With this combination, you can do anything an Apple can do. It's easy to switch from one language system to the other and you'll never be frustrated by not being able to use one of those really great programs.

Converting Integer to Applesoft

There have been several attempts to write a program to convert Integer Basic to Applesoft. For short, uncomplicated programs, this can sometimes be easily done. The more sophisticated the program (and the programmer) the more difficult the task is. The hard way is to type in the program, making syntax and command changes as you go. Provided, of course, that you're aware of all the differences. Another way creates a text file out of the Integer Basic program and recreates the same program in Applesoft. A way to do this was described in Apple's Contact #5. Here's how they did it (note that @ means Control D):

```
0 PRINT" @ OPEN X"
1 POKE 33,33
2 PRINT" @ WRITE X"
3 LIST
4 PRINT" @ CLOSE"
5 END
```

For your Apple II....

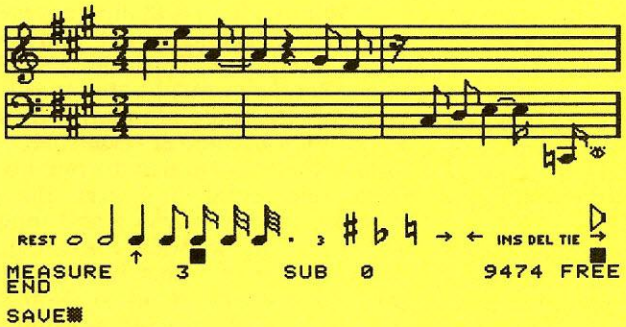
MUSIC & GRAPHICS

ALF Music Synthesizer

The ALF music synthesizer has three voices on each board which are easily programmed using the Entry program provided. The envelope shape of each voice (or even each note) may be controlled individually thus allowing the synthesis of practically any instrument such as a violin, trumpet, piano, harp or bells. Instrumentation and dynamics may be varied while a song is playing by changing the attack, sustain, release, decay, gap and volume of the notes.

Playback of music is accompanied by a spectacular color display showing a stylized "piano keyboard" for each part with the colors of the notes varying in proportion to their loudness and waveform.

Ease of Music Entry

Music is entered directly using the high-resolution graphics entry program. One paddle is used to select menu items such as note duration, accidentals, dotted notes, triplets, tied notes, etc. while the other paddle moves a note cursor up and down the staff over a 4-octave range. The transpose command extends the range to eight octaves. This form of music entry is considerably faster and more accurate than cryptic note code schemes (like QFS3) found with other synthesizers.

MUSIC ENTRY SCREEN

Advanced Features

The Entry program also permits easy editing of previously-entered music including insert, delete and change. New parts may be added (up to nine—3 parts per board). "Subroutines" can be used for repeated parts, codas, and fugues.

The board plugs into any Apple II or Apple II Plus. Two or three boards are required for stereo. Requires a 16K Apple system and external amplifier and speakers.

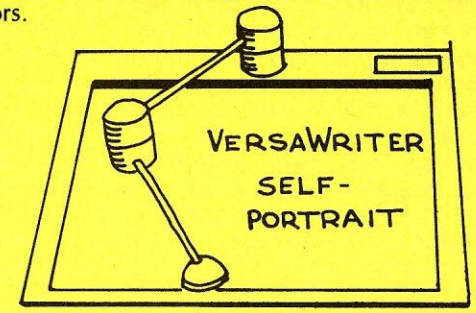
> "Phil Tubb's ALF music board sets high standards in ease of music entry, stereo output and overall flexibility."
> Creative Computing Magazine, June 1979

Six music disks will be available in June.

VersaWriter

VersaWriter is a drawing tablet for the creation of full-color, high resolution graphic images on the Apple. Images may be drawn freehand or traced from existing images (cartoons, photos, drawings, etc.) using the simple pivoted two-arm pantograph with magnifying crosshairs.

After an image is drawn, it may be rotated, shrunk, or enlarged. It may be moved across the screen and alternated with other images thus providing high-resolution animation. The image may be colored with varied colors.



Animate other Programs

Graphical images made with VersaWriter and stored on tape or disk may be called from other programs or even imbedded in them. With VersaWriter, you don't have to worry about assembly code, counting pixels or other cumbersome hi-res graphics entry and retrieval techniques.

VersaWriter graphics can be used in all types of programs—games, statistics, engineering, artistic, and educational. Your only limit is your own imagination.

Two Disks of Software

Disk 1 contains the basic plotting, scaling, movement, rotation, color, transfer and recall software. This disk also includes routines which create "shape tables" from your figures to be used in other programs. Disk 2 contains applications software. One program adds five sizes of upper and lower case text to drawings, another adds standard electronic and digital symbols, while a third calculates distances and areas.

VersaWriter requires a 32 or 48K disk system, Applesoft in ROM or an Apple II Plus.

VersaWriter	$252.00
ALF Music Synthesizer	$268.00
ALF/Applesoft Software	15.00

Prices postpaid in USA. NJ residents add 5% sales tax.

To order VersaWriter or the ALF Synthesizer, send your name and address along with a check or chargecard number and expiration date. Visa, MasterCard and American Express are welcome. Units are in stock and orders will be shipped as soon as your check clears or your credit is verified.

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CIRCLE 207 ON READER SERVICE CARD

Apple, cont'd...

This program could have been written all on one line, too. Enter the routine anywhere in your Integer Basic program. A line 0 is most convenient. Don't forget, you need a Disk II system to do this. Once entered, RUN the new program. A file named "X" will be OPENed and the program you're working on will be listed into that file. After the disk stops, type FP to change to Applesoft and EXEC the file. Your program is now in Applesoft. Of course, you had to have both Basics in the Apple being used to do this (your own or a friend's). A program could be written to completely interpret from one language to the other. But I doubt that anyone would want to pay the price for it, and it probably wouldn't fit in an Apple anyway.

Now that you have gotten the Integer program in Applesoft, the real fun (?) begins. You will need to search for and change all the command and syntax differences. Let's look at a comparison list of these differences.

- Input commands
  IB - INPUT"APPLES", A use a comma
  AS-INPUT"APPLES"; A use a semicolon
- String commands
  IB - PRINT A$(I,I)
  AS - PRINT MID$(A$,I,1)

There is only one form of string command in Integer. Applesoft also includes the LEFT$, RIGHT$, VAL and STR$ commands.

- MOD functions
  IB - POKE 1, TRY MOD 256
  AS - POKE 1, TRY - INT(TRY/256) *256
  or
  IB - Z=X MOD Y
  AS - Z=X-INT(X/Y)*Y
- IF statements
  IB - IF X THEN 200 : GOTO 500
  AS - IF X THEN 200
  GOTO 500

In Integer, if X is false (0) the program reads the next statement following the colon. In Applesoft, if X is false the program drops to the NEXT line no.

- Inequalities
  IB - IF X#Y THEN 500
  AS - IF X<>Y THEN 500

Integer uses a # sign to mean does-not-equal.

- Variable names
  IB - TRY1 = TRY2 + TRY3
  AS - T1 = T2 + T3

Applesoft recognizes only the first 2 characters as the variable.

- Random numbers
  IB - X = RND(16)
  AS - X = INT(16*RND(1))

Another way to generate random integers in Applesoft uses the random variable format, X%.

  AS - X% = 16*RND(1)

- Integers
  IB -TRY1 = TRY2
  AS - T1% = T2%

This is the same result as changing to random integers in the previous example. It is not always necessary to change the variables to integers. The program will run faster and use less memory if you do.

- DIM statements

  IB - DIM A$(20)

means, 1 string 20 characters long.

  AS - DIM A$(20)

means, 20 strings up to 255 characters long. Remove all DIM statements from the program. You do need to dimension the quantity of AS strings if there are more than 10.

- TAB statements

Change all IB TAB statements to AS HTAB statements.

- Computed GOTO s
  IB - GOTO 1000 + X * 100
  AS - ON X GOTO 1100,1200, 1300,1400

If 4 program options exist, then branching will occur as a function of the selected option number (X=1 to 4).

- Page 0

Relocate any machine code used by IB in page 0. Some of page 3 is usually available. Or, move LOMEM up to make room above $800. Change all CALLs accordingly.

Now you can see why I called it fun (?). If you are real serious about converting Integer to Applesoft, it can be done. But I would opt for the Integer Basic card if at all possible.

Assembly Language

With the built-in assembly language capability of the Apple, it seems a shame that a beginners guide is not available. There are a number of books available that describe assembly language for the type of microprocessor in the Apple II. All of them assume prior knowledge of fundamental principles. For those of you who would like to begin at the beginning, let's attempt a tutorial for the neophyte assembly language programmer.

Background

The differences between Apple II, with and without Autostart, and the Apple II plus relative to using the Apple II monitor need to be known. The monitor is a collection of assembly language programs. Included in these programs are routines to handle input from the keyboard, translation of commands to computer functions and display of results on the video screen. In fact, the ease with which you can do things with your Apple is the result of programs in the monitor. Imagine if you had to enter each key stroke, one character at a time, with a group of panel switches. We'll get back to the monitor later.

Here's how to get the monitor with each version of the Apple. The result is to see the asterisk (*) prompt.

- Apple II - without Applesoft ROM; Power on and press Reset. Press Reset any other time too.
- Apple II - with Applesoft ROM; Press Reset as without ROM except make sure the switch on the ROM card is in the Integer Basic position (Press Control + B to check).
- Apple II - with autostart; Autostart will automatically put you in the resident Basic language. You will need to type CALL-151 + Return to get to the monitor. Same conditions with the ROM card switch.
- Apple II plus - with Integer card; It is also possible to get into the Apple monitor without the integer cards. But, you won't be able to write assembly language programs. There is no mini-assembler available. A CALL-151 will put you in the monitor. From this point you can dump memory, modify memory and move memory. But, without the Integer card, that's it. A future column will describe the use of an assembler. The use of a full fledged assembler will solve the problem in the Apple II plus without integer Basic capability.

Monitor Commands

A variety of commands is available for your use when the asterisk prompt is present.

- List and dump memory
- Modify and move memory
- Examine and verify memory
- Save to, and load from, cassette
- Hexadecimal arithmetic
- Mini-assembler (Integer system only)
- Many others

The various options and commands and other features of the Apple II monitor are found on pages 68 through 75 in the old Apple II Reference Manual (the red book). Even more information on the moni-

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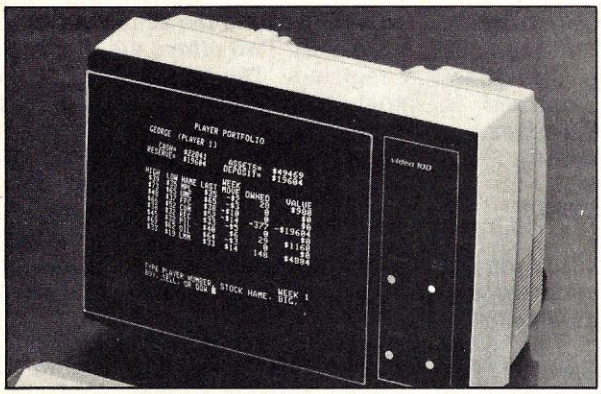

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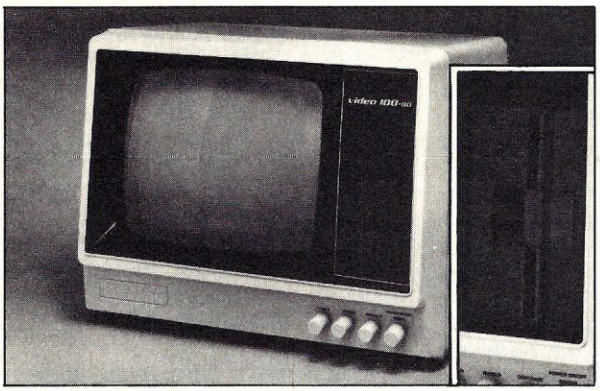

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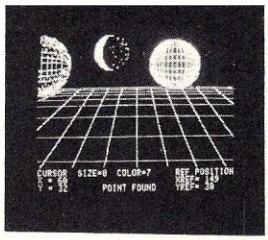

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THE DESIGNER is a user oriented APPLESOFT program that does the HPLOTing for you. Sometimes referred to as the 'poor man's graphics tablet', it places lines and complex circular functions on the APPLE HIRES screen with the use of game controls and single key-strokes. 2 page animations, disk save and recall, and simple cursor-driven executions are among the features of this crash proof program.

REQUIRES 48K APPLE/APPLESOFT ROM/DISK

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CIRCLE 115 ON READER SERVICE CARD

Apple, cont'd...

tor can be found on pages 39 through 66 in the new Apple II Reference Manual. Incidentally, the new manual is great. If you're serious about learning the inner-workings of your computer, this is the book to have. Now, back to assembly language.

Binary and HEX

If you understand the relationships between binary, decimal and hexadecimal numbers, then the discussion of assembly language will be easier. The range of addresses used to define memory location is $0000 to $FFFF. The $ is used to indicate a HEX number. In decimal, the range is 0 to 65535 or 65536 memory locations. There is no need to consider the binary value of the address. Only the data found at the memory location are used. The address lets you find where the data are.

Data in a memory cell is called a byte. A byte is made up of 8 bits, and each bit is represented by a '1' or a '0.' A one means the bit is on; a zero means the bit is off. Four bits, called a nybble, represent a hexadecimal number. It takes two hexadecimal numbers—nybbles—to represent the binary data byte in a memory location. You will want to learn the relationships between binary, hexadecimal and decimal numbers. In assembly language programming, it is often necessary to know the binary pattern in a memory location. You will become comfortable using binary and hexadecimal numbers as you get more skilled with assembly language programming. Much more on computer number systems will be found in the listed references. Also, study the memory maps found in your Apple reference manuals and programming books. These will help you understand how Apple's memory is used.

Assembly Language

There are at least 2 ways you can enter assembly language into your Apple II. One is to hand write the program, hand assemble it and use monitor routines to enter it one byte at a time. The other uses the Apple II mini-assembler. Before we try to write and enter an assembly language program, some knowledge of the parts of a program is needed. Then, we will look at writing assembly language programs and converting them to machine language. Some of the features of the Apple's 6502 microprocessor will be examined, too.

The Instructions

Microprocessors use a set of codes for commands and instructions. The 6502 microprocessor has a set of instructions that has 55 codes. These codes are called **mnemonics** (ni-mon-ick—this means easy to remember). By themselves, the mnemonic instruction codes can't tell the 6502 what needs to be done. Additional information called an **operand** is used with most instruction codes.

Mnemonic	Operand
LDA	#$C1
JSR	$FDED
RTS	

This example is called an assembly language program. In order to use this little routine, it must be converted to machine language. This is the job of an assembler program. We will use the Apple II mini-assembler later in this article to write a program.

Operation Codes

Each instruction code also has a corresponding Hex value called an operation code. These opcodes (short for operation codes) are recognized by the system monitor and converted to binary values for the 6502. Actually, the computer only recognizes binary numbers. If you were to examine the memory cells during program execution, you would only find patterns of 1's and 0's. To make it easier for you to converse with the computer, binary has been converted to a coded machine language. One step above hexadecimal machine language is assembly language. Assembly language uses mnemonic instructions called opcodes, and data called operands to simplify programming. Pages 100 through 105 in the 'red book' and pages 118 through 128 in the new Reference Manual include all the 6502 instructions (mnemonics), opcodes and address modes. These are also included in the reference material.

Address Modes

Operands used with each instruction code identify which opcode to use for the instruction. Operands also tell the computer which address mode to use. Address modes instruct the computer to do something specific with the contents of the operand. There are several possible address modes that can be used with many of the instructions. Depending on the results and type of program, different address modes are possible with each instruction code. We will only use 3 address modes in the examples used here.

More About the 6502

Microprocessors, like the 6502, have internal read/write (RAM) memory called registers. These registers allow the programmer to move instructions and data into and out of the microprocessor. One register is called the accumulator (or A register). Two others are the X and Y registers. The accumulator is the most important register in the 6502. Many program steps will put data in the accumulator then put it into some memory location. Sometimes an operation is performed on the value in the accumulator directly. Two operations that occur in this process are called **load** and **store.** Load causes a value to be placed in a 6502 register. Store takes data from a 6502 register and puts it into an external memory location.

Instructions, Addresses and Opcodes

Instruction codes used for accumulator operations are LDA and STA. The three letter mnemonic is made up from characters in the instruction.

LDA (**LoaD A**ccumulator)
STA (**STore A**ccumulator)

The instruction LDA means two things: 1 - lead the value in the operand into the accumulator or, 2 - load the value found at the address in the operand into the accumulator. The 6502 knows which to do by the way you write the operand. Depending on the form used, the addressing mode is defined accordingly. Here are two examples for the LDA instruction.

1. LDA #$C1 (Immediate addressing mode)
2. LDA $0300 (Absolute addressing mode)

In example 1, the # sign (using 6502 conventions) indicates that the accumulator is to be loaded with $C1. (Remember that a $ in front of a number means HEX.) Example 2 indicates to the 6502 that it is to get the value found at memory location $0300, and load it into the accumulator.

Instruction STA means that the 6502 will take the value presently in the accumulator and store it in the address specified by the operand. For example, STA $0300 means take the value in the accumulator and store it in location $0300. Two other instructions we will use are JSR (**J**ump to **S**ub**R**outine) and RTS (**R**e**T**urn from **S**ubroutine).

Remember we said that mnemonic instruction codes could be represented by HEX opcodes. Here is a

SPACE WAR

You're in command in **SPACE WAR!** Destroy your opponent's ship by forcing him to collide with the sun or to explode upon re-entry from hyperspace. . . or challenge him face to face with missile fire. You're in command of the speed and direction of your ship. You control the timing of your missiles. You select the game mode from five options, including Reverse Gravity, and the battle begins. . . Accelerate to place your shots--and escape into hyperspace before your opponent comes within range. But be wary, he (or she!) may circle out of sight and reappear on the opposite side of the galaxy! (This is the classic MIT game redesigned especially for the Apple.)

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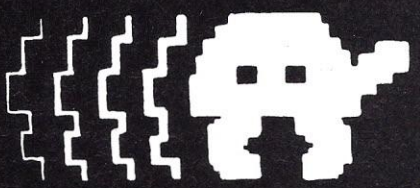

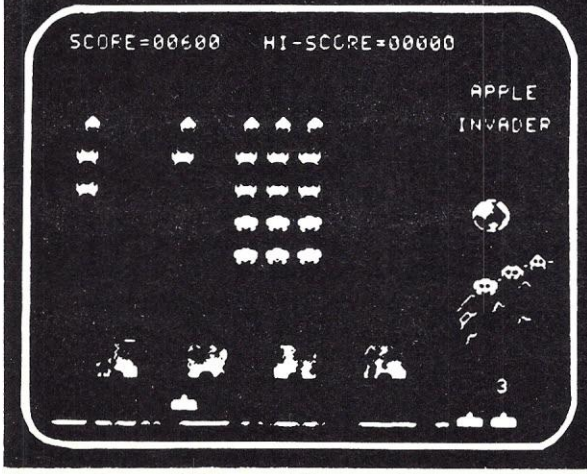

Fifty-five aliens advance and shower you with lethal writhing electric worms. As you pick off the aliens, one-by-one, they quicken their descent. They whiz across the screen wearing away your parapets, your only defense, coming closer and closer to your level. **Super Invasion** is the **original** invasion game with the original moon creatures and faster action than any other invasion game on the market.

Super Invasion is available for only $19.95 on cassette (CS-4006) for a 32K Apple II. **Space War** is $14.95 on cassette (CS-4009) for a 16K Apple II. **Space War** and **Super Invasion** are on one disk (CS-4508) for a 48K Apple II for only $29.95.

Send payment plus $1.00 shipping and handling to Creative Computing Software, P.O. Box 789-M, Morristown, NJ 07960. NJ residents add $1.00 sales tax. Bankcard orders may be called in toll free to 800/631-8112. In NJ call 201/540-0445.

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Apple, cont'd...

list of the codes used so far:

Opcode	Instruction	Address Mode
$A9	LDA	Immediate
$AD	LDA	Absolute
$80	STA	Absolute
$20	JSR	Absolute
$60	RTS	Implied

As mentioned earlier, there are many instruction codes, addressing modes and opcodes in the 6502 instruction set. Check them out in the reference material.

Assembling a Program

Let's write a short program using everything discussed so far. Here's how to do it. First, select the starting point in memory. There is space for short programs at address $0300. So our program will start there. (Otherwise, use any space in memory not used by Apple programs; consult the memory maps.) Now write the assembly language part of the program with appropriate operands. Then look up the opcodes and hand assemble the machine code. The starting address of our program, $0300, is the beginning of page 3 of memory. (Page 0 starts at $0000 and ends at $00FF, page 1 is from $0100 to $01FF, page 2 from $0200 to $02FF, page 3 from $0300 to $03FF and so on. There are a total of 256,256-byte pages.)

New conventions introduced in the sample program will include the single byte, two byte and three byte instructions, and also the arrangement of the bytes in the three byte instruction. Depending on the instruction used and the data in the operand field, the opcode is assembled with the required number of data bytes. Immediate mode addressing uses the opcode (always first) then one byte of data. Absolute mode uses two bytes of data. Following the opcode, the least significant byte of the data in the operand is entered, then the most significant byte. Here's an illustration of the concept.

```
$C030 ←Hex address (operand)
  └└──Least significant byte
   └──Most significant byte
```

Implied mode (the RTS instruction, for example) uses only single byte opcodes. The instruction itself includes all the information needed for the desired end result. Instruction RTS is used when you call one program from another. The return from subroutine returns you back to a point where you want to continue in your program (or subroutine).

Inst.	Operand	Comment
LDA	#$C1	;load the accumulator with $C1
JSR	$FDED	; jump to character-out routine
JSR	$FBE4	; jump to bell routine
RTS		; make a definite return

Figure 1

Now, back to our program. The program we will write will:

1- load the accumulator (LDA with a value

2- jump to a subroutine (JSR) that prints the contents of the accumulator on the screen

3- jump to another subroutine (JSR) to beep the bell, and

4- end the program (RTS).

First, write the assembly language program that will do these things. I'll provide you with the value for the accumulator and the subroutine addresses for the operands to get things going (see Figure 1).

Our program will start at address $0300 and will use consecutive memory locations starting with the opcode for LDA immediate. The next memory location will contain the data in the operand. An opcode always has to be the first byte of data in your program. Otherwise, the computer won't be able to recognize legitimate instructions. Often, some form of LDA will be the first instruction. Let's begin.

0300- A9
0301- C1

Look up the opcodes for each of the other mnemonic instruction codes and write them down. (we did this earlier). Now, write the opcode for JSR in the next consecutive memory location, followed by the data in the operand. Remember the sequence of the bytes of data in the operand.

0302- 20
0303- ED
0304- FD

Now do the same thing with the next JSR and operand.

0305- 20
0306- E4
0307- FB

And, complete the program with the single byte instruction, JSR.

0308- 60

Of course, the complete program won't look like this in the Apple mini-assembler format. The following example represents how it will look.

*300L

	Machine Code	Assembly Code	
0300-	A9 C1	LDA	#$C1
0302-	20 ED FD	JSR	$FDED
0305-	20 E4 FB	JSR	$FBE4
0308-	60	RTS	

Note that the opcode follows each address and is followed by the data as defined by the operand.

Apple II mini-assembler

Now let's try the mini-assembler to write a program. In the following sequence, you will be typing in the underlined characters. Computer response is not underlined. Also, it is not necessary to use the $ character or leading zeros. The mini-assembler takes care of these things. The character ⧸b (slash b) means to type a blank with the space bar. Remember, too, to type Return when you want your entries to be accepted (see Figure 2).

You have just assembled a program starting at location $0300. Notice that it is not necessary to leave spaces in your entries either. The assembler can tell what is what.

Now run the program using the following sequence.

$300G ; run program from assembler

A ; see an A, hear a beep

Figure 2

Step	Action	Comments
1.	**F666G**	; enter mini-assem. at F666
2.	!□	; see prompt and cursor
3.	**300:LDA #C1**	; first line to assemble
4.	0300- A9 C1 LDA #$C1	; see assembled output
5.	**⧸JSR FDED**	; next line to assemble
6.	0302- 20 ED FD JSR $FDED	; see assembled output
7.	**⧸JSR FBE4**	; next line to assemble
8.	0305- 20 E4 FB JSR $FBE4	; see assembled output
9.	**⧸RTS**	; last line to assemble
10.	0308- 60 RTS	; see assembled output

Apple, cont'd...

What we just did was to run the program from inside the mini-assembler. This is what happened in the assembly process.

First, the start location in memory was selected. Address $0300 was the choice. Apple's mini-assembler assumes all addresses and data are in HEX. The only place the $ is used, in the disassembled listing, is in the operand. Next, the value $C1 was loaded into the accumulator. An immediate mode instruction did this. The HEX value $C1 represents the character A.

In steps 5 and 6, a JSR instruction was assembled. The operands used represent two subroutines in the Apple II monitor. A character output routine is at $FDED. This routine puts the value currently in the accumulator on the screen. Recall that our first instruction loaded the HEX value for A in the accumulator. A routine at address $FDE4 is called BELL2. This routine generates the beep heard in the speaker. The program we assembled ends with the RTS instruction. Note that any program you run from the monitor should end with the RTS instruction. The monitor command, such as 300G, is a jump (JRS) to the specified address. To get back to the monitor where you started, you must include the RTS. Otherwise.....CRASH!

When inside the mini-assembler, the $ is used to indicate a monitor command. Typing 300G and Return ran the program as though you were in the monitor, and that's what happened when you pressed Return. The computer went to address $0300 and followed the instructions found there. Each event occurred in the order it was written. **Remember**: The first instruction where you enter the program has to be an opcode. The program would abort or run wild if it did not use a legitimate sequence of instructions.

To exit from the mini-assembler press Reset, or if you have the autostart ROM type $FF69G and Return. Now type 300L and press Return. A listing of 20 disassembled lines will appear on the screen. Only the first 5 lines include our character output and bell ringing routine. You should be able to recognize them from previous examples. There may be other data listed there too, but it's not valid for this program.

Try One Yourself

You can run this program as often as you want by typing 300G and Return. Try experimenting with different values in the accumulator. Numbers 0 to 9 are values $B0 to $B9. Letters A to Z are values $C1 to $DA. A space is $A0 and a carriage return is $8D. Write a program to print out your name or the current date. Hint: Use LDA immediate for each character you want to print along with a JSR to the character output routine. End a line with a carriage return, and end the program with RTS. Explore these and experiment. You can't do anything more than mess-up your own programs.

Reference Material

Here's a short list of sources where you can find additional information on 6502 assembly language programming

1. **6502 Assembly Language Programming**, Leventhal, Osborne -1979
2. **6500 Programming Manual**, Rockwell, Synertech, Commodore
3. **Programming the 6502**, Zaks, Sybex -1978
4. **6502 Applications Book**, Zaks, Sybex -1979

We'll talk about indexing, assemblers and other assembly language fundamentals in future columns.

Empirical Music

Here's a useful routine for creating tones or musical notes contributed by Richard Ferri. He uses it to determine just the right sound needed for his programs. The program comes in two parts. The machine language tone generating routine and a Basic program to provide interactive input of values for the pitch (frequency) and duration. The values of A and B in the Basic program must be less than 255.

First, using monitor commands, enter the machine language.

```
0308- FF FF AD 30 C0 88 D0 05
0310- CE 09 03 F0 09 CA D0 F5
0318- AE 08 03 4C 0A 03 60
```

Second, type in this Applesoft program and run it.

```
100  REM  MACHINE LANGUAGE SUBROUTINE
110  HOME : PRINT : PRINT : PRINT
120  INPUT "WHAT IS THE VALUE OF 'A' (FREQUENCY)? ";A
130  PRINT : PRINT
140  INPUT "WHAT IS THE VALUE OF 'B' (DURATION)? ";B
150  POKE 776,A: POKE 777,B: CALL 778
160  VTAB 14: HTAB 15: PRINT "A= ";A
170  VTAB 16: HTAB 15: PRINT "B= ";B
180  GET X$: GOTO 100
```

And there you have it—empirical music. Anyone else with something to share? □

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Intelligent Computer Games

Correspondence is welcome. Letters with interesting questions and ideas will be used in the column along with a response. No personal replies can be made. Send to: David Levy, 104 Hamilton Terrace, London NW8 9UP, England

In last month's article we introduced the extremely powerful Alpha-Beta algorithm for searching two-person game trees, and we saw how dramatic the effects of alpha-beta pruning can be when the branches of the tree are searched in their optimal order. Although optimal ordering is impossible to achieve (if we knew what the best move was, there would be no need to search the game tree to find it), there are a number of techniques which help to improve the speed of the search process, and it is these techniques which form the subject of this month's article.

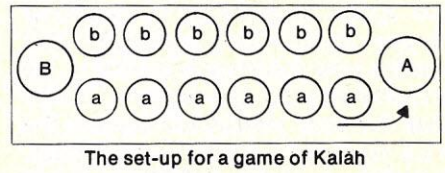
Ordering by Short Look-ahead

Consider a program which searches a game tree to a depth of 10-ply. If the average branching factor is 36, as in chess, the tree will be enormous and any saving that can be achieved by optimizing the order of the search will be well worthwhile. One way in which this might be done is to carry out a much shorter look-ahead search, to a depth of 3-ply for example, and then order the moves on the basis of this shallower search. Once this has been done, the search routine moves down the tree and performs its full search of the tree, the first 3-ply of which have already been put into an approximate order. As a result of the approximate ordering, the full look-ahead search is conducted in a more efficient manner, with considerable savings in time. The following example should help the reader convince himself of the value of conducting a preliminary search.

Let us suppose that in a chess position there are 36 moves. On the basis of a shallow search it appears that move m_1 wins the opponent's queen, move m_2 wins only a pawn, and no other moves force the win of any material. At the other end of the scale, move m_{35} appears to lose a pawn while m_{36} looks as though it loses a bishop. The program now orders these 36 moves on the basis of its preliminary look-ahead, and it first carries out a full 10-ply search on the move that appears to win the queen, m_1. Unless there is some deep reason why this move does not win the queen, the programs alpha-beta search will return a score to the root of the tree that indicates its opinion that move m_1 wins a queen. It then looks at move m_2, but finds fairly early in the search that m_2 does not win a queen, and so the number of branches which are pruned off during the search process will be high. The same thing happens when the full search process examines m_3, m_4, ...m_{35}, m_{36}. The reason why we need to order all 36 moves is that our ordering will not be absolutely correct, but the effect of an error in one or more value judgements will be minimized if we make the preliminary ordering as accurate as possible. For example, if move m_{36} actually turned out to win a bishop instead of losing a bishop, the move would still be inferior to m_1 (winning a queen) so we would still wish to examine m_{36} after examining m_1.

Some interesting results on preliminary ordering were discovered by Richard Russell who wrote a Kalah program in 1964. Kalah (or Owari) is one of a family of games that go under the generic name Mancala. These games are played in Asia and Africa, and the rules vary slightly from one region to another. The game presents an ideal programming exercise because the rules are simple, the branching factor is typically no more than 6, and it is relatively simple to devise a satisfactory evaluation function.

Each player controls a number of pits or bowls (often pits in the sand) and one large pit or bowl called his Kalah. In the above diagram the pits labelled a and the Kalah labelled A all belong to one player, pits b and



The set-up for a game of Kalah

Kalah B belong to his opponent. At the start of the game each pit contains an equal number of stones, say 5, and each Kalah is empty.

The players move alternately. To make a move a player picks up all the stones in one of his pits and, moving his hand in an anti-clockwise direction, drops one stone into each pit and into his own Kalah, but not into his opponent's Kalah. When his hand holds no more stones the player has had his turn, and it is then his opponent's turn to play, but if the last stone lands in a player's Kalah he has another turn, so it is advantageous to plan the game so that you will have two or more turns in succession. The other important rule is that if a player's last stone lands in an empty pit on his own side, he captures all of the stones in the opposite pit and places them, together with the stone making the capture, in his own Kalah.

At the end of the game the player with the most stones in his Kalah is the winner.

Russell experimented with preliminary searches of various depths. With a full look-ahead of 10-ply he discovered that the program consumed the minimum CPU time when 90% of its total search time was spent in the short look-ahead of 5-ply. He then found a method for improving the search speed still further. Rather than begin a new 5-ply search at each ply, he used the fact that the short look-ahead searches overlap—the 5-ply search conduct-

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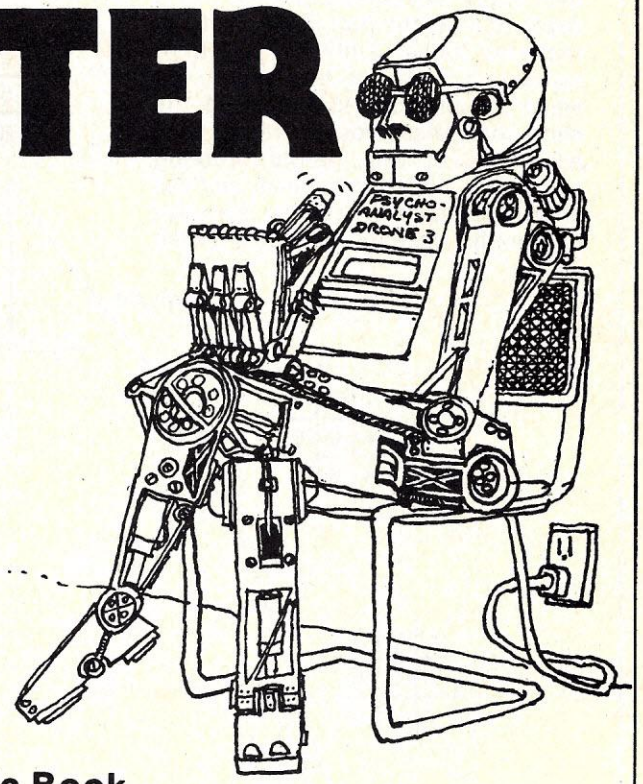

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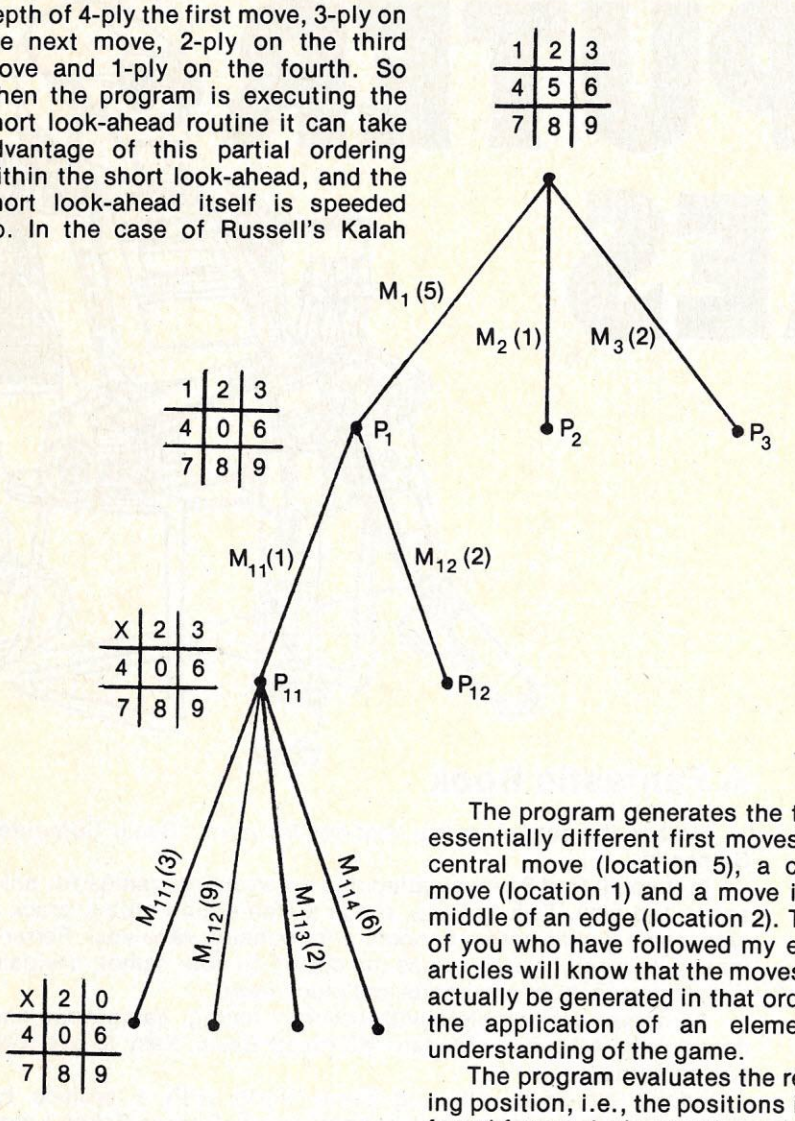
Games, cont'd...

ed at one position in the tree could be used as a 4-ply search of a position at the next level down in the tree. This means that a short look-ahead of 5-ply would have its own short look-ahead ordered: to a depth of 4-ply the first move, 3-ply on the next move, 2-ply on the third move and 1-ply on the fourth. So when the program is executing the short look-ahead routine it can take advantage of this partial ordering within the short look-ahead, and the short look-ahead itself is speeded up. In the case of Russell's Kalah program this technique produced a reduction in total search time of approximately 65%.



One of the problems of implementing this short look-ahead method on a personal computer is the need to store the whole of the short look-ahead tree. For most games this will be impossible without a floppy disk system, and even then there will be games for which there is insufficient memory to cope with anything more than a 1-ply or 3-ply short look-ahead search. Nevertheless, the idea is worth remembering, either for games with relatively small branching factors, or for the day when you upgrade your micro by adding a bubble memory. But with even the smallest memory configuration you can utilize this method to some extent, simply by restricting your short look-ahead to a 1-ply search! Let us see how this might work in practice, using noughts and crosses (tic-tac-toe) as our example.

The program generates the three, essentially different first moves: the central move (location 5), a corner move (location 1) and a move in the middle of an edge (location 2). Those of you who have followed my earlier articles will know that the moves may actually be generated in that order by the application of an elementary understanding of the game.

The program evaluates the resulting position, i.e., the positions it has found from a 1-ply search, and sorts them so that the best move is examined first. We shall assume that our evaluation function retains the order in which the moves were generated, in which case the program next generates the moves from position P_1, the position arising after making the central move (location 5). In reply to this move there are two essentially different moves, a corner (location 1) and the middle of an edge (location 2). We generate these moves in exactly that order, and then we evaluate the resulting positions (P_{11} and P_{12}) using our evaluation function. Let us assume that the scores for P_{11} and P_{12} indicate that P_{11} is a better position than P_{12} from our opponent's point of view. Then on the basis of the 1-ply search conducted from position P_1 we can say that the next set of moves to be generated should be the successors of position P_{11}. Here there are four, essentially different moves: a corner on the same edge as the Z (location 3), the opposite corner (location 9), the middle of an edge adjacent to the X (location 2), and the middle of an empty edge (location 6). The program then evaluates all four of these positions, and on the basis of the 1-ply search conducted from P_{11} it orders them in such a way that the move most favorable from its own point of view is the one which will be expanded first.

Thus the process continues. As each bunch of successor moves is generated, the resulting positions are evaluated and then sorted. Admittedly the sorting will be nowhere near 100% accurate, but it should certainly be sufficiently accurate to result in effective pruning when the program reaches the bottom of the tree and begins its alpha-beta search.

I touched briefly on this method in my previous article, but I felt it worthwhile re-iterating my point by means of this example, because the notion of an ordered search is so very fundamental to efficient tree-searching, and this method is relatively painless to program.

The Killer Heuristic

Imagine that you are playing a game, thinking about which move you should make next. You come up with the idea of making move M_1, but then you notice that if you do play this move your opponent has the very strong reply ZAP at his disposal, completely wrecking your position. You therefore stop thinking about M_1 and start to think about another move, M_2, but now you have been forewarned because you have already spent some of your thinking time on the discovery of the refutation move ZAP. You therefore look to see whether M_2 can be met by ZAP, and if so, with what result.

The logic behind this approach is not difficult to understand. If ZAP kills your prospects of victory after you make the move M_1, it is quite possible, even likely, that ZAP will ruin you after you make the move M_2. In chess and many other games there is the concept of the threat, and ZAP moves often fall into this category. If your queen is threatened and you play a random move, the chances are that your opponent will be able to

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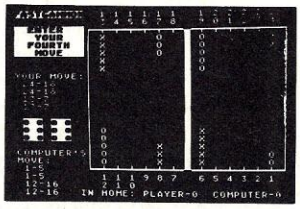

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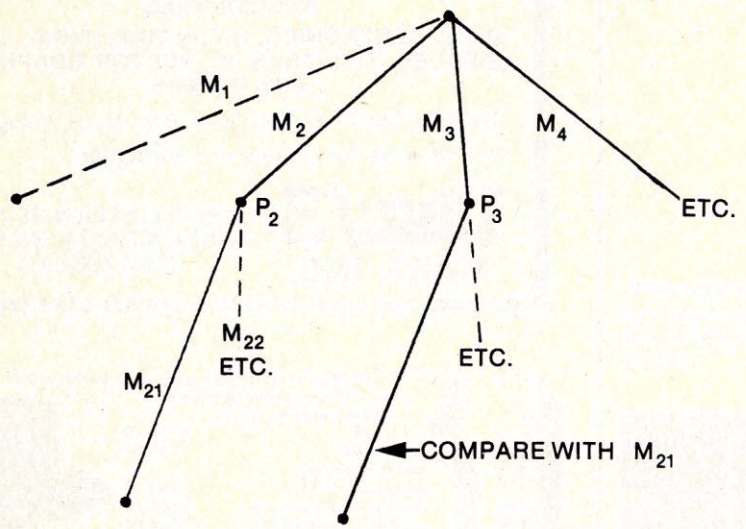
capture your queen on his next turn. Each time you think of a move you should first look to see if it loses your queen in the same way, and if it does so then you will have pruned off large chunks of the game tree simply by finding the refutation move (sometimes called the "killer" move) early in the search.

The implementation of the killer heuristic is not difficult, but it does require the use of extra RAM. At each level in the tree, keep a note of which move produced the last cutoff (this is the killer move) and try that move first when examining the next group of positions at the same level. This method becomes clearer from an examination of the following example.



The program has already looked at the first move from the root of the tree, and returned a score to the root position. It now examines move M_2, leading to position P_2, and soon discovers that in reply to M_2 if its opponent chooses M_{21} then the opponent will have improved on his score which is currently at the root of the tree. In other words, move M_{21} refutes move M_2, and the program need not look at M_{22}, M_{23}, ...etc.

Next the program examines move M_3. It knows that M_{21} refuted M_2 so it first looks at its list of legal moves from position P_3 to see if the same move as M_{21} can be found in this list—if so it examines that move first, in the hope of finding that here, too, the same move provides a refutation, thereby terminating the search from M_3 after examining the minimum number of branches. If it turns out that M_3 is refuted by a different move, then this new killer move replaces the original one and it is this new killer which is looked for first when examining the successors to M_4.

There are various ways in which this heuristic may be refined and expanded, but each of them requires still more RAM. Instead of storing just one killer move at each level, the program could store (say) the first five killer moves that it encountered at each level and keep a note of how often each killer was used as a refutation move at that level. Each time the count for one of the killers was updated, all five killers could be ordered so that the next time the program reached this level of look-ahead it examined the most frequently used killer first, then the second most frequently used, and so on.

Another idea is to store killer moves linked to the moves that they refute, and then use this information at different depths of search. For example, if it was discovered that in a chess position the move e2-e4 by White was refuted by the reply c7-c5, then wherever the move e2-e4 was found in the tree, whether it be at 3-ply, 5-ply, 7-ply or deeper, the first move to be examined for Black would be c7-c5. Again the logic behind this use of the heuristic is easy to understand—a decision which is bad today will probably be bad in a similar situation tomorrow.

The Principal Continuation

When a program has finished its search of the game tree, and has decided on its move, it will have in its memory the path through the tree which it considers to represent the best play by both sides. Its own best move will be at the top of the tree, then the move which it expects its opponent to make in reply, then the move which it thinks is the most likely reply to its opponent's expected move, and so on. It seems a pity to waste this information when so much effort has been put into its acquisition, and no more memory is required to take advantage of the information than one needs for the killer heuristic. Simply use the 3rd ply move from the current search as the first move to be examined when the program next begins to compute a move. The 4th ply move in the current search can serve as the first "killer" at ply-2 in the next search; the 5th ply move now can be the first killer at ply-3 next time, and so on. Very little computation time will be taken up with this method, and it is as well to start your search looking at vaguely sensible moves.

The Alpha-Beta Window

This is another trick, inexpensive in terms of code, which will often speed up the search process. Under certain circumstances it may actually slow down the speed of search but if the parameters are carefully chosen the overall effect will be beneficial.

In most games it is true to say that in general it will not be possible to force a substantial gain within the next ply, nor will it be likely that the player whose turn it is to move must concede a substantial loss. In view of this it seems unreasonable to set the values of alpha and beta to $-\infty$ and $+\infty$, respectively, at the start of the search. Let us take chess as our example. We can start our search by assuming that White (whose turn it is to move) cannot force the win of more than two pawns, and that White is not faced with the inevitable loss of more than two pawns. We can therefore set the "window" to be four pawns wide, by assigning to alpha and beta the values of minus two pawns and plus two pawns respectively. This means that when searching for a move for White the program will only examine moves which, at worst, lose two pawns for White, and when looking for Black moves the program will ignore all moves which permit White to win more than two pawns. This process will speed up the tree search provided that the true value of the root position does lie within the window. Occasionally though, it will be possible for White to win more than two pawns or impossible for White to avoid conceding more than two pawns. Under these circumstances the search will terminate without the values of alpha and beta undergoing any change, and the program must then think again, widening its window.

Games, cont'd...

The Flowchart

The flowchart that follows illustrates how the alpha-beta algorithm works when backing-up in the tree search. This diagram is an abbreviated form of Figure 4 from Whaland's excellent article (see bibliography).

i is the ply number currently under investigation.

L(i) is a pointer to the list of moves possible at level i (all sharing the same parent move at level i-1).

M(i) is the move, at level i, currently being processed.

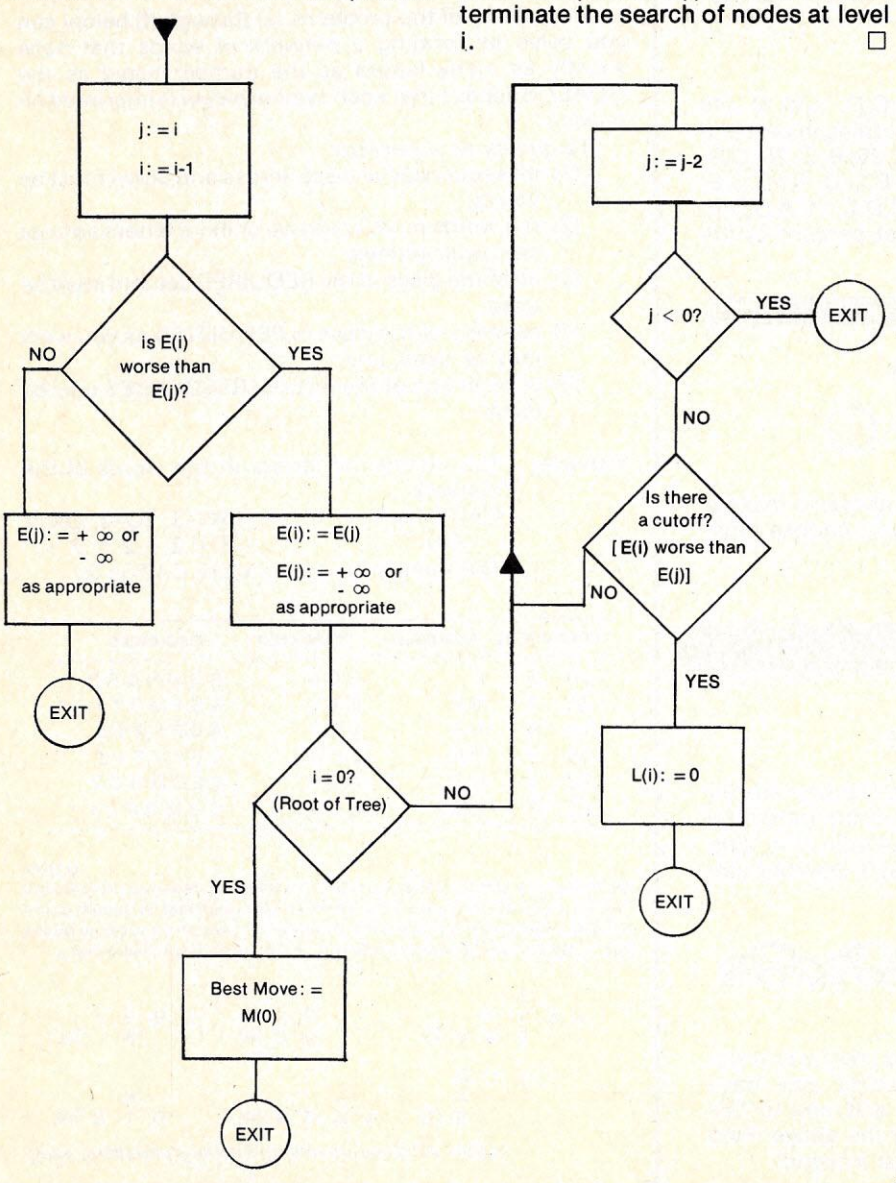
E(i) is the evaluation of this move.

The left hand part of the tree assigns values to the nodes as the search proceeds. A value of $+\infty$ is assigned as initial values to nodes at odd depths, and $-\infty$ as initial values to nodes at even depths. These are the values which are to be bettered if a candidate node is to be acceptable.

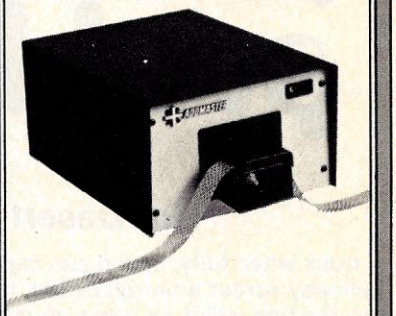
The program compares the value of E(i) with E(i-1) and replaces E(i-1) with E(i) if E(i-1) is "worse than" E(i). To be worse than E(i), it is necessary for either: E(i-1) to be greater than E(i) and i to be even; or E(i-1) to be less than E(i) and i to be odd.

When there are no more moves to consider from a particular node, the value of E(i-1) is compared with E(i-2), and so on, back up through the tree, until E(1) replaces E(O) whereupon the move leading to the evaluation E(1) is the best move found so far from the root of the tree. Once all moves from the root have been examined (or search time is exhausted), this move is played.

The right hand side of the flow chart performs the pruning made possible by the alpha-beta algorithm. When a new value of E(i) is found, the alpha-beta routine compares it with the evaluation at ply i-1. If a cutoff is found the pointer L(i) is set to zero to terminate the search of nodes at level i. □



RS232C Paper Tape Transmitter



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puzzles & problems

Hot Desert Sands

A truck when fully loaded can carry enough fuel to take it half-way across a barren desert. If the truck can return to the starting point as often as is necessary, what is the minimum amount of fuel required to take it all the way across? Assume that any amount of fuel can be taken from the truck at any point in the desert and this amount will remain undiminished until subsequently collected.

No Problem!

A teacher assigned 5 problems: A,B,C,D, and E. He noticed that the percentage of students turning in problem A was 46%;B, 40;C, 43; D, 38; E, 41; A,B, 25; B,C, 26; C,D, 26; D,E, 22; A,E, 30; A,B,E, 19; A,B,C, 13; B,C,D, 12; C,D,E, 14; A,D,E, 16; A,B,C,D, 7; B,C,D,E, 6; A,C,D,E, 11; A,B,D,E, 9; A,B,C,E, 8; and A,B,C,D,E, 4%. What percent of the students did not turn in any problems?

Sum Problem!

Put five different digits in the circles above to make a correct multiplication. The five digits you choose must total 27.

Jogging Practice

A man is on a bridge from A to B, 3/8 of the way across from A. He hears a train approaching A at the rate of 60 mph. If he runs toward A he will meet the train at A; if he runs toward B the train will overtake him at B. How fast can he run?

The Greatest!

Write a program to determine the greatest integer that can be stored and retrieved for the machine you have available. What is the result when you add one to this number? Conjecture on the reasons for the above. Find out the same information for the smallest integer!!

Hank Kepher

True Love

Some emotional problems are incurable./ All emotional problems are deviations from the norm./ If some deviations from the norm are incurable, then to be spurned is not a deviation from the norm./ To have a true love and yet be spurned is an emotional problem./ Is it possible to have a true love and yet be spurned?

Thinkers' Corner

© Layman E. Allen

WORD PUZZLES

How many of the problems (a) through (f) below can you solve by forming a network of words that have exactly as many letters as the number listed as the GOAL? (Suppose that each symbol below is imprinted on a disc.)

To qualify as a network

(1) all sequences of discs across and down must be words,
(2) the words must have two or more letters and not be proper names,
(3) all of the discs in the REQUIRED column must be used,
(4) as many of the discs in PERMITTED as you wish may be used, and
(5) at most one of the discs in RESOURCES may be used.

Example: The number of letters in the words of the network

CAT is 7:
ON

CAT=3, TO=2, ON=2
3 + 2 + 2 = 7

The number in the network CAT is 3.

PROB.	GOAL	REQUIRED	PERMITTED	RESOURCES
[a]	5	I	C G N	B G M N Q R U
[b]	6	H Y	E M S	A C F M O T Y
[c]	6	A G	D O T	A B D F R S Z
[d]	6	M V	E F I R	C E F M T Y Z
[e]	8	N O	A O Y	B E D M N O Y
[f]	12	A E S	E H S T	C G M Q R U Y

Some Suggested Answers (frequently there are others):

[a] B I G N
[b] H O M E Y
[c] B A G O T
[d] M E R Y
[e] O N N O
[f] S H E A T E S Y

If you enjoy this kind of puzzle, you may like playing ON-WORDS: The Game of Word Structures. Free information about this and other instructional games is available upon request from The Foundation for the Enhancement of Human Intelligence, 1900-W Packard Road, Ann Arbor, MI 48104.

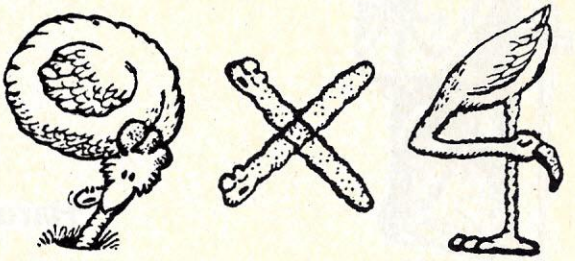
puzzles & problems

Plotting With A Pond

A farmer, as a present, gave his son all the land the son could separate in a rectangular plot with 600 yards of fence. The son, however, used part of a pond as one side of his plot. Find the maximum area the son could have received.

Reversed

There are two numbers formed of the same two digits in reverse order. The sum of the numbers is 33 times the difference between the two digits, and the difference between the squares of the two numbers is 4752. Find the numbers.



The Remainders

What number, if divided by 10, leaves a remainder of 9; divided by 9 leaves a remainder of 8; divided by 8 leaves a remainder of 7,..., divided by 2 leaves a remainder of 1. One answer is 14,622,042,959. Find a smaller solution.

Ugly Basic

Find the hidden word without using a computer. (There are no prizes).

Colin Wells
The Downs School
Dartford, Kent, England

```
10 GOTO 210
20 FOR A=1 TO 3
30 IF A>1 THEN 50
40 GOTO 140
50 FOR B=1 TO 2
60 IF A<3 THEN 90
70 PRINT"E";
80 GOTO 130
90 IF A=2 THEN 120
100 PRINT"M";
110 GOTO 130
120 PRINT"T";
130 NEXT B
135 GOTO 160
140 PRINT"O";
150 GOTO 50
160 IF A<2 THEN 180
170 GOTO 190
180 PRINT"I";
190 NEXT A
200 GOTO 230
210 PRINT"C";
220 GOTO20
230 END
```

Problems of Dates

David H. Ahl

MARCH · 1980						
S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	(27)	28	29
30	31					

March 27, 1980 expressed in numeric "date shorthand" is sometimes written 3/27/1980. This is unusual in that it has seven different digits—the first four (0,1,2,3) and the last three (7,8,9). Write computer programs to solve the following problems.

1. How many dates in the 1980 decade also have sequences of the first four and last three integers and what are they?

2. In the same decade how many dates have sequences of:

A. The first two and last five integers
B. The first three and last four integers
C. The first five and last two integers
D. The first three and last three integers

3. Between the year 1000 and 4000 how many dates in each century exhibit the first property above? (That is, have sequences of the first four and last three integers). Before running the program make a prediction of the pattern these 30 numbers will exhibit. Do the numbers conform to your prediction? What is the pattern?

P.S.—Heard this one?

There are two integers each between 1 and 100. P knows their product; S knows their sum. Obviously, if they told each other the sum and product, they could figure out what the integers were. Instead, they have the following conversation:

P: I don't know what the numbers are.
S: I knew you didn't. Neither do I.
P: Oh! Now I know.
S: Oh! So do I.

What are the two integers?

Clarification: The two integers are between 1 and 100 exclusive. This, according to anonymous reports, allows a unique solution.

Questions:

- Can anyone solve this without a computer? (Or to rephrase the question, can anyone solve this WITH a computer?)
- How significant is the 100?
- What solutions are possible if the restriction is 1-200?

The comments and opinions of the author are given for educational purposes only and are not meant to be legal advice. Specific legal questions should be referred to your personal attorney.

Harold L. Novick

The battlelines over the patentability of software have been drawn for more than a decade. Each side has hardened its respective position and staked out its respective territory. The dialog on this controversy will be continued this month and from time to time in the future so that the problems, disadvantages and advantages of the patent system in general and of software patentability in particular can be appreciated.

First, however, in the interest of fairness, the reader should know that this writer is clearly biased in favor of patents for software. Thus, the reader should not expect a purely objective presentation of both sides, although an honest attempt will be made to give one.

During a recent conversation with Professor George Davida of the University of Wisconsin, he asked the typical questions most people raise when questioning the patentability of software. How can software be patentable when there is usually nothing new in most computer programs? In any case, with most computer programs being kept secret and because of the huge number of computer programs, how could the Patent & Trademark Office possibly search a software invention to determine its novelty? Finally, what value would there be to software patents if one could never tell when someone else was improperly making, using or selling the patented software?

The simple reply to all of these questions is that their answers are immaterial to a conceptual inquiry about whether computer programs are proper patentable subject matter. Consider the chemical industry which selects from less than 100 different building blocks (i.e., atoms) to make every one of its millions upon millions of chemical substances. Sometimes the chemical substance is novel, and sometimes only the method of making it is novel. It is doubted if anyone would seriously argue that a novel chemical substance was unpatentable subject matter because none of its component atoms were new. Similarly, it is doubted if anyone would argue that a new method of making a known chemical substance was improper patentable subject matter simply because it would be difficult, if not impossible, to detect infringement of the process. Obviously, novel chemical substances are patentable subject matter in spite of the impossible task of searching through every chemical substance produced by man. These concerns should not determine whether software is patentable or unpatentable subject matter.

The United States Department of Justice and the Patent & Trademark Office have jointly argued against the patentability of software on many occasions. In a recent legal brief filed in the U.S. Supreme Court, they asked the Court to decide whether "a computer program that regulates the internal operation of a computer is patentable subject matter . . ." **Diamond, Commissioner of Patents and Trademarks v. Bradley,** Case. No. 79-855. The invention in this case involves an improved method of using firmware for changing the data in scratchpad registers of some high performance computers.

The patent examiner refused to grant a patent for the Bradley invention on the basis that "the only novel aspect of the invention resided in an algorithm designed to control the multiprogramming computer to solve the particular problem indicated," and a program implemented algorithm is not patentable according to another Supreme Court decision (**Gottschalk v. Benson,** 409 US 63 (1972). When the Court of Customs and Patent Appeals (CCPA) reversed the Patent and Trademark Office's refusal to grant a patent, the government filed their brief before the Supreme Court requesting a reinstatement of the refusal to grant the patent.

The government's arguments present the case against the patentability of software. The CCPA was criticized for not following the government's interpretation of two prior Supreme Court cases, the **Benson** case mentioned above and the more recent case of **Parker v. Flook,** 437 U.S. 584 (1978). The CCPA, says the government, should first look at the claimed invention (the written single sentence description in the patent application) to "determine whether the claim contains a principle, formula, idea or concept which, as one of the 'basic tools of scientific and technological work,' is itself unpatentable and must be separated from the rest of the claim." Secondly, the CCPA should have analyzed what remains of the claim to determine whether it is old in the art.

In the **Bradley** case, what remained in the claims, said the patent examiner, was a main memory, a central processing unit, and scratchpad registers, all of which were well known and admittedly old. Thus, the government argued that the CCPA should not have reversed the Patent and Trademark Office.

Harold L. Novick, Patent Attorney, LARSON, TAYLOR & HINDS, Arlington, VA 22202.

Forum, cont'd...

This is the government's argument (with the references being omitted):

> The Court [i.e., the CCPA] compounded these errors [not applying the above two step test] by assuming that, so long as the algorithm was not mathematical, its patentability under Section 101 [of the Patent Act] posed no problems. Undoubtedly, a claim whose only novel element is a computer program expressing a mathematical algorithm is not patentable subject matter. **Benson** and **Flook** make that clear. But although the algorithms in **Flook** and **Benson** were mathematical, the Court's holdings did not rest on any distinction between mathematical and non-mathematical algorithms. The Court broadly stated in Benson that "[p]henomena of nature, though just discovered, mental processes, and abstract intellectual concepts are not patentable, as they are the basic tools of scientific and technological work." The Court in **Flook** had the same broad focus when it stated that "[d]ifficult questions of policy concerning the kinds of programs that may be appropriate for patent protection and the form and duration of such protection can be answered by Congress on the basis of current empirical data not equally available to this tribunal."
>
> Phenomena of nature, mental processes and abstract intellectual concepts may be mathematical, but they need not be. Indeed, most ideas and concepts are not mathematical, yet the absence of mathematical expression does not make them any more the subject of the patent laws. The phenomena that water runs downhill and that the sun rises in the east are not more patentable than mathematical equations.
>
> So it is with computer programs. The proper inquiry is whether the program, be it mathematical or non-mathematical, expresses a phenomenon of nature, mental process, or an abstract intellectual concept. Bradley's program, when measured against this standard, is no more patentable than the algorithms involved in **Benson** and **Flook.** Like programs generally, Bradley's program is a set of directions to the computer. It commands the switching of data, of whatever type, untied to any particular end use. Although the directions are for the movement of information in the computer system base, they as much reflect abstract intellectual concepts as directions for the translation of texts from Russian to English (*In re Toma,* 575 F.2d 872 (CCPA 1978)) or for a hitherto unknown and faster route between Washington and New York. The computer programmer simply uses the computer to implement the idea embodied in the program.

What is wrong with the government's position and where are its arguments fallacious? Think about it for a month. Reread its arguments a few times. Look at the application of those arguments to mechanical inventions which are usually always employing a plurality of known components, but in different ways. Ask how can anything be patentable if these arguments are carried to their logical extension. And, most importantly, read next month's column. □

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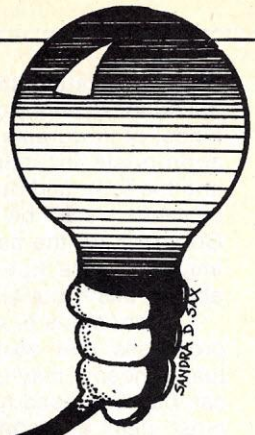


Computers

SELF-CONTAINED MICROCOMPUTER

Zeda Computers International has introduced the Zeda 580, a completely self-contained microcomputer with central processing unit, CRT display and dual minifloppy disk drives housed in one desktop-sized metal cabinet.

The heart of the CPU with its 65K of dynamic RAM is a 4 Mhz, Z-80A microprocessor. The system supports two RS-232 serial ports, two parallel ports plus a parallel printer port, one hard disk port, and one floppy disk drive connector capable of supporting two external floppy disk drives—either mini or eight-inch. All interfaces are fully programmable and expandable.

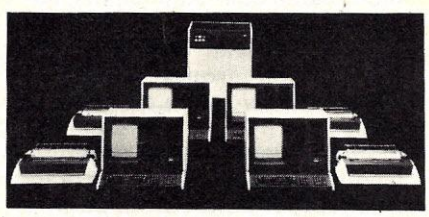
The CP/M compatible ZDOS disk operating system handles all interrupts, data transmissions, keyboard definition, error detection, and disk storage and retrieval. $6837.

Zeda Computers International, 1662 West 820, North, Provo, UT 84601. (801) 377-9948.

CIRCLE 240 ON READER SERVICE CARD

SHARED RESOURCE WORD PROCESSING

Shared Resource word processing systems from CPT Corporation provide growth while protecting users' investments. The systems, including Wordpak I and Wordpak II large-capacity information storage peripherals, range from single CPT 8000 system configurations to multi-user information networks.



Wordpak I allows up to four users to store and retrieve documents on a fixed disk storage device with 25 million character capacity.

Wordpak II systems give as many as eight users access to 50 million characters of fixed disk storage. Each CPT 8000 word processing system also includes an additional 600,000 characters of flexible diskette storage as well as 64,000 characters of main memory at every operator position.

Major components of Wordpak Systems can include two 25 million character Winchester-type fixed disk drives and two new disk interfaces.

CPT Corporation, 1001 Second St., South, Hopkins, MN 55343, (612) 935-0381.

CIRCLE 241 ON READER SERVICE CARD

ALTOS ANNOUNCES HARD DISK SYSTEM

Up to four simultaneous users can take advantage of as much as 58 Megabytes of hard-disk, on-line storage in the Altos Computer Systems ACS8000-6 computer system. Using a double-sized printed circuit board, the system incorporates all the logic needed to control up to four 14.5-Megabyte Shugart disks using Winchester-type technology.

Prices for the ASC8000-6 series of Altos computers range from $9,450 for a single-user device with two floppy disk drives and one 14.5-Megabyte hard disk platter to $14,260 for the four-user, 29-Megabyte device with two dual-sided floppy disk units.

Altos Computer Systems, 2338A Walsh Ave., Santa Clara, CA 95050.

CIRCLE 242 ON READER SERVICE CARD

Miscellaneous

COMPUTER EDUCATION PROGRAM

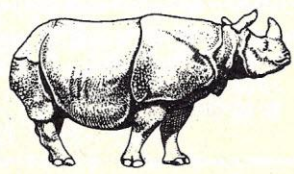
"Little Computers . . . See How They Run," a series of eight videocassette computer education programs, has just been released by Evolution 1, a division of Electronic Data Systems Corporation.

The videocassettes, and accompanying student learning materials, present a range of information that takes the participant from the fundamentals of microcomputers through the technical intricacies of how the computer receives, processes, stores and transmits information.

Each lesson is illustrated with dozens of graphics filled with colorful visual examples, and is based on a carefully structured presentation of gradually increasing difficulty, with the participant advancing one step at a time.

Electronic Data Systems Corporation, EDS Center, 7171 Forest Lane, Dallas, TX 75230. (800) 527-0278.

CIRCLE 243 ON READER SERVICE CARD



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RCA Cosmac Super Elf Computer $106.95

Compare features before you decide to buy any other computer. There is no other computer on the market today that has all the desirable benefits of the **Super Elf** for so little money. The Super Elf is a small single board computer that does many **big** things. It is an excellent computer for training and for learning programming with its machine language and yet it is easily **expanded** with **additional memory, Full Basic, ASCII Keyboards, video character generation, etc.**

Before you buy another small computer, see if it includes the following features: ROM monitor; State and Mode displays; Single step; Optional address displays; Power Supply; Audio Amplifier and Speaker; Fully socketed for all IC's; Real cost of in warranty repairs; Full documentation.

The **Super Elf** includes a **ROM** monitor for program loading, editing and execution with **SINGLE STEP for program debugging** which is not included in others at the same price. With **SINGLE STEP** you can see the microprocessor chip operating with the **unique Quest** address and data bus displays **before, during** and **after** executing instructions. Also, CPU mode and instruction cycle are decoded and displayed on 8 LED indicators.

An RCA 1861 **video graphics** chip allows you to connect to your own TV with an inexpensive video modulator to do graphics and games. There is a **speaker system** included for writing your own music or using many music programs already written. The speaker amplifier may also be used to drive relays for control purposes.

A 24 key **HEX keyboard** includes 16 HEX keys plus **load, reset, run, wait, input, memory protect, monitor select** and **single step**. Large, on board displays provide output and optional **high and low address**. There is a 44 pin standard connector slot for PC cards and a 50 pin connector slot for the Quest Super Expansion Board. Power supply and sockets for **all** IC's are included in the price plus a detailed 127 pg. instruction manual which now includes over 40 pgs. of software info. including a series of lessons to help get you started and a music program and graphics target game. Many schools and universities are using the Super Elf as a course of study. OEM's use it for training and R&D.

Remember, other computers only offer Super Elf features at additional cost or not at all. **Compare before you buy. Super Elf Kit $106.95, High address option $8.95, Low address option $9.95. Custom Cabinet** with drilled and labelled plexiglass front panel **$24.95.** Expansion Cabinet with room for 4 S-100 boards **$41.00. NiCad Battery Memory Saver Kit $6.95.** All kits and options also completely assembled and tested.

Questdata, a 12 page monthly software publication for 1802 computer users is available by subscription for $12.00 per year. Issues 1-12 bound $16.50.

Tiny Basic Cassette **$10.00,** on ROM **$38.00,** original Elf kit board **$14.95. 1802 software;** Moews Video Graphics **$3.50.** Games and Music **$3.00,** Chip 8 Interpreter **$5.50.**

Super Expansion Board with Cassette Interface $89.95

This is truly an astounding value! This board has been designed to allow **you** to decide how you want it optioned. **The Super Expansion Board comes with 4K of low power RAM** fully addressable anywhere in 64K with built-in memory protect and a **cassette interface**. Provisions have been made for all other options on the same board and it fits neatly into the hardwood cabinet alongside the **Super Elf**. The board includes slots for up to 6K of **EPROM** (2708, 2758, 2716 or TI 2716) and is **fully socketed.** EPROM can be used for the monitor and Tiny Basic or other purposes.

A 1K Super ROM Monitor $19.95 is available as an on board option in 2708 EPROM which has been preprogrammed with a program loader/editor and error checking multi file cassette read/write software, (relocatible cassette file) another exclusive from Quest. It includes register save and readout, block move capability and video graphics driver with blinking cursor. Break points can be used with the register save feature to isolate program bugs quickly, then follow with single step. The Super Monitor is written with subroutines allowing users to take advantage of monitor functions simply by calling them up. Improvements and revisions are easily done with the monitor. If you have the **Super Expansion Board** and **Super Monitor** the monitor is up and running at the push of a button.

Other on board options include **Parallel Input and Output Ports** with **full handshake**. They allow easy connection of an ASCII keyboard to the input port. **RS 232 and 20 ma Current Loop** for teletype or other device are on board and if you need more memory there are two **S-100** slots for static RAM or video boards. Also a 1K Super Monitor version 2 with video driver for full capability display with Tiny Basic and a video interface board. **Parallel I/O Ports $9.85, RS 232 $4.50, TTY 20 ma I/F $1.95, S-100 $4.50. A 50 pin connector set** with ribbon cable is available at $15.25 for easy connection between the **Super Elf** and the **Super Expansion Board.**

Power Supply Kit for the complete system (see Multi-volt Power Supply below).

INTEGRATED CIRCUITS

7400TTL		LM323K-5	5.95	CD4021	1.25				
7400N	.17	LM320K-12	1.50	CD4022	1.10				
7402N	.18	LM320K-15	1.50	CD4023	.28				
7404N	.19	LM320T-5	1.60	CD4024	.75	2104A-4	4.95		
7409N	.23	LM320T-8	1.60	CD4025	.28	2107B-6	3.75		
7410N	.18	LM320T-12	1.50	CD4026	2.00	2111-1	3.75		
7414N	.70	LM320T-15	1.60	CD4027	.66	2112-2	3.95		
7420N	.18	LM324N	1.15	CD4028	.85	2114L 300ns	7.40		
7422N	.39	LM339N	1.55	CD4029	1.02	4116 200ns	9.50		
7430N	.20	LM340K-5	1.35	CD4030	.45	8/4116 200ns	64.00		
7442N	.50	LM340K-8	1.35	CD4035	1.02	2513B	6.30		
7445N	.69	LM340K-12	1.35	CD4040	1.02	MM5262	.40		
7447N	.60	LM340K-15	1.35	CD4042	.85	MM5280	3.00		
7448N	.69	LM340K-24	1.35	CD4043	.85	MM5320	9.95		
7450N	.18	LM340T-5	1.25	CD4044	.85	MM5330	5.94		
7474N	.35	LM340T-8	1.25	CD4046	1.67	PD411D-3	4.00		
7475N	.49	LM340T-12	1.25	CD4049	.45	PD411D-4	5.00		
7485N	.88	LM340T-15	1.25	CD4050	.45	P5101L	8.95		
7489N	1.85	LM340T-18	1.25	CD4051	1.13	4200A	9.95		
7490N	.43	LM340T-24	1.25	CD4060	1.42	82S25	2.90		
7492N	.43	LM343H	4.50	CD4066	.71	91L02A	1.50		
7493N	.43	LM350	7.50	CD4068	.40	HD0165-5	6.95		
7495N	.69	LM370	5.15	CD4069	.40	MM5700	4.50		
74100N	.90	LM377	3.00	CD4070	.50	GIAY38500-1	9.95		
74107N	.35	LM379	5.00	CD4071	.28	MCM66751A	9.95		
74121N	.34	LM380N	1.00	CD4072	.28	9368	3.50		
74123N	.59	LM381	1.60	CD4073	.28	410D	10.00		
74125N	.45	LM382	1.60	CD4075	.28	416	16.00		
74145N	.69	LM703H	.40	CD4076	1.45				
74150N	.95	LM709H	.28	CD4078	.40	**CLOCKS**			
74151N	.69	LM723H/N	.50	CD4081	.28	MM5311	5.50		
74154N	1.00	LM733N	.67	CD4082	.28	MM5312	3.90		
74157N	.69	LM741CH	.35	CD4116	.47	MM5314	3.90		
74161N	.87	LM741N	.32	CD4490	5.50	MM5369	2.10		
74162N	.87	LM747H/N	.75	CD4507	1.00	MM5841	14.45		
74163N	.87	LM748N	.35	CD4508	4.25	MM5865	7.95		
74174N	.96	LM1302N	1.75	CD4510	1.02	CT7001	5.80		
74175N	.90	LM1304	1.10	CD4511	.94	CT7010	8.95		
74190N	1.15	LM1305	1.27	CD4515	2.52	CT7015	8.95		
74192N	.87	LM1307	2.00	CD4516	1.10	MM5375AA/N	3.90		
74193N	.85	LM1310	2.75	CD4516	1.02	MM5375AG/N	4.90		
74221N	2.00	LM1458	.47	CD4520	1.02	7205	16.50		
74298N	1.65	LM1800	1.75	CD4527	1.51	7207	7.50		
74365N	.66	LM1812	7.50	CD4528	.79	7208	15.95		
74366N	.66	LM1889	3.00	CD4553	3.50	7209	4.95		
74367N	.66	LM2111	1.75	CD4566	2.25	DS0026CN	3.75		
		LM2902	1.50	CD4583	4.50	DS0056CN	3.75		
74LS00 TTL		LM3900N	.60	CD4585	1.10	MM53104	2.50		
74LS00N	.35	LM3905	1.75	CD40192	3.00				
74LS02N	.35	LM3909N	.89	74C00	.28	**MICROPROCESSOR**			
74LS04N	.35	MC1458V	.50	74C04	.40	6502	12.50		
74LS05N	.35	NE540H	3.75	74C10	.28	6504	16.50		
74LS08N	.35	NE550N	1.00	74C14	2.10	6522	13.60		
74LS10N	.35	NE555V	.39	74C20	.28	6800	17.50		
74LS13N	.55	NE556A	.85	74C30	.28	6802	18.75		
74LS14N	1.10	NE565A	1.00	74C48	1.95	6820	9.95		
74LS20N	.35	NE566V	1.50	74C74	.75	6850	12.95		
74LS22N	.35	NE567V	1.00	74C76	1.40	8080A	8.95		
74LS28N	.41	NE570B	5.00	74C90	1.15	8085	27.00		
74LS30N	.35	78L05	.60	74C93	1.40	8086	75.00		
74LS33N	.75	78L08	.60	74C154	3.00	Z80	14.75		
74LS38N	.55	78M05	.85	74C160	1.44	Z80A	19.75		
74LS74N	1.25	75108	1.75	74C175	1.35	8212	2.90		
74LS75N	1.00	75491CN	.50	74C192	1.85	8214	8.00		
74LS90N	.85	75492CN	.55	74C221	2.00	8216	2.90		
74LS93N	.70	75494CN	.89	74C905	6.00	8224	2.90		
74LS95N	1.10			74C906	.75	8228	5.35		
74LS107N	.45	**A to D CONVERTER**		74C914	1.95	8251	8.50		
74LS112N	.45	80388	4.50	74C922	5.50	8253	15.00		
74LS113N	.35	8700CJ	13.95	74C923	5.50	8255	9.25		
74LS132N	.89	8701CN	22.00	74C925	6.95	8257	19.50		
74LS136N	.45	8750CJ	13.95	74C926	6.95	8259	19.50		
74LS151N	.85	LD130	9.95	74C927	6.95	1802CP plas	13.95		
74LS155N	.85	9400CJV/F	7.40			1802DP plas	17.95		
74LS157N	.85	ICL7102	9.50	**INTERFACE**		1861P	11.50		
74LS162N	1.15	ICL7107	14.25	8095	.65	CDP1802CD	19.95		
74LS163N	1.15			8096	.65	CDP1802D	25.00		
74LS174N	2.00	**CMOS**		8097	.65	CDP1861	12.95		
74LS190N	1.45	CD34001 Pair	.50	8098	.65				
74LS221N	1.95	CD4000	.16	8709	1.25	**UART/FIFO**			
74LS258N	.67	CD4001	.28	8110	4.50	AY5-1013	5.50		
74LS367N	1.35	CD4002	.28	8113	3.00	AY5-1014	7.50		
		CD4006	1.10	8120	5.50	3341	6.95		
LINEAR		CD4007	.28	8123	3.10				
CA3045	.90	CD4008	.28	8124	3.50	**PROM**			
CA3046	1.10	CD4009	.45	8125	3.20	1702A	3.95		
CA3081	1.80	CD4010	.45	8126	1.69	2513B upper case	6.95		
CA3082	1.90	CD4011	.28	8128	2.75	2513B lower case	6.95		
CA3089	2.95	CD4012	.28	8197	1.69	2716T1	24.50		
LM301AN/AH	.35	CD4013	.39	8198	1.69	2716 Intel	34.95		
LM305H	.87	CD4014	1.00			8/2716 Intel	240.00		
LM307N	.35	CD4015	1.00	**MOS/MEMORY**		2732	85.00		
LM308N	.89	CD4016	.45	**RAM**		2758	22.50		
LM309K	1.50	CD4017	1.05	2101-1	3.95	8741A	85.00		
LM311H/N	.90	CD4018	.94	2102-1	.95	8748	75.00		
LM3177/K	3.75	CD4019	.45	2102AL-4	1.25	8748-8	70.00		
LM318	1.35	CD4020	1.02	2102AN-2L	1.60	8755A	65.00		
LM320K-5	1.50			21L02-1	1.18	N82S23	2.95		
						N82S123	3.50		

N82S126	3.75
N82S129	3.75
N82S131	3.75
N82S136	8.75
N82S137	8.75
DM8577	2.90
8223	2.90
8/2716 Intel	240.00

CONNECTORS

30 pin edge	2.50
44 pin edge	2.75
100 pin edge	4.50
100 pin edge WW	5.25

IC SOCKETS

Solder Tin Low Profile			
PIN	1UP	PIN	1UP
8	.15	22	.30
14	.14	24	.35
16	.16	28	.42
18	.27	36	.58
20	.29	40	.57

2 level 14 pin ww .20

WIRE WRAP LEVEL 3

PIN		PIN	
14	.32	24	.86
16	.33	28	1.00
18	.57	40	1.23

CRYSTALS

1 MHz	4.50
2 MHz	4.50
4 MHz	4.25
5 MHz	4.25
10 MHz	4.25
18 MHz	3.90
20 MHz	3.90
32 MHz	3.90
32768 Hz	4.00
1.8432 MHz	4.50
3.5795 MHz	1.20
2.0100 MHz	1.95
2.097152 MHz	4.50
2.4576 MHz	4.50
3.2768 MHz	4.50
5.0688 MHz	4.50
5.185 MHz	4.50
5.7143 MHz	4.50
5.5536 MHz	4.50
14.31818 MHz	4.25
18.432 MHz	4.50
22.1184 MHz	4.50

KEYBOARD ENCODERS

AY5-2376	$12.50
AY5-3600	17.95
AY5-9100	10.50
AY5-9200	16.50
74C922	5.50
74C923	5.50
HD0165-5	6.95

D Connectors RS232

DB25P	2.95
DB25S	3.95
Cover	1.50
RS232 Complete Set	6.50
DE9P	1.95
DA15P	2.10
DA15S	3.10

Hickok 3½ Digit LED
multimeter 69.95
Stopwatch Kit 26.95
Auto Clock Kit 17.95

Not a Cheap Clock Kit $14.95
Includes everything except case. 2-PC boards. 6- 50" LED Displays. 5314 clock chip, transformer, all components and full instructions. Orange displays also avail. **Same kit w/.88" displays.** Red only **$21.95** Case **$11.75**

8K/16K Eprom Kit
(less PROMS) $89.00
Motherboard $39.00
Extender Board $8.99

RESISTORS ¼ watt 5%
10 per type .03 1000 per type .012
25 per type .025 350 piece pack
100 per type .015 5 per type 6.75
½ watt 5% per type .05

KEYBOARDS

56 key ASCII keyboard kit	$67.50
Fully assembled	77.50
53 key ASCII keyboard kit	60.00
Fully assembled	70.00
Enclosure	14.95
Metal Enclosure	29.95

LEDS

Red T018	15
Green, Yellow T018	20
Jumbo Red	20
Green, Orange, Yellow Jumbo	25

Cliplite LED Mounting Clips 8/$1.25 (specify red, amber, green, yellow, clear)

CONTINENTAL SPECIALTIES in stock
Complete line of breadboard test equip.
MAX-100 8 digit Freq. Ctr. $128.95

OK WIRE WRAP TOOLS in stock
Portable Multimeter $18.00

SPECIAL PRODUCTS
MM5865 Stopwatch Timer with 10 pg. spec. 9.00
PC board 7.50
Switches Mom. Pushbutton .27
3 pos. slide .25
Encoder HD0165-5 6.95
Paralonics 100A Logic
Analyzer Kit $224.00
Model 10 Trigger Expander Kit $229.00
Model 150 Bus Grabber Kit $369.00
Sinclair 3½ Digit Multimeter $59.95
Clock Calendar Kit $23.95
2.5 MHz Frequency Counter Kit $37.50
30 MHz Frequency Counter Kit $47.75

TRANSFORMERS

6V 300 ma	3.25
12 Volt 300 ma transformer	1.25
12.6V CT 600 ma	3.75
12V 250 ma wall plug	2.95
12V CT 250 ma wall plug	3.50
24V CT 400 ma	3.95
10V 1.2 amp wall plug	4.85
12V 6 amp	12.95
12V 500 ma wall plug	4.75
12V 1 amp wall plug	6.50
12V 3 amp	8.50
10/15 VAC 8/16 VA wall plug	9.75

DISPLAY LEDS

MAN1	CA	.270	2.90
MAN3	CC	.125	.39
MAN72/74	CA/CA	.300	1.00
DL704	CC	.300	1.25
DL707/DL707R	CA	.300	1.00
DL727/728	CA/CC	.500	1.90
DL747/750	CA/CC	.600	1.95
DL750	CC	.600	1.95
FND359	CC	.357	.70
FND500/507	CC/CA	.500	1.35
FND503/510	CC/CA	.500	.90
FND800/807	CC/CA	.800	2.20
3 digit Bubble			.60
4 digit Bubble			.80
DG8 Fluorescent			1.75
DG10 Fluorescent			1.75
5 digit 14 pin display			1.00
10 digit display			1.25
7520 Clairex photocells			.39
TIL311 Hex			9.50
MAN3640	CC	.30	1.10
MAN4610	CA	.40	1.20
MAN4640	CC	.40	1.20
MAN4710	CA	.40	.95
MAN4740	CC	.40	1.20
MAN6640	CC	.56	2.95
MAN6710	CA	.60	1.35
MAN6740	CC	.60	1.35

MA1002A	**8.95**
MA1002E	**8.95**
MA1012A	**8.95**
102P3 transformer	**2.25**

ROCKWELL AIM 65 Computer

6502 based single board with full ASCII keyboard and 20 column thermal printer. 20 char. alphanumeric display, ROM monitor, fully expandable. $375.00. 4K version $450.00. 4K Assembler $85.00, 8K Basic Interpreter $100.00.

Special small power supply for AIM65 assem. in frame **$49.00.** Complete AIM65 in thin briefcase with power supply **$485.00.** Molded plastic enclosure to fit AIM65 plus power supply **$47.50.** Special Package Price: 4K AIM, 8K Basic, power supply, cabinet **$599.00**

AIM65/KIM/VIM/Super Elf 44 pin expansion board; 3 female and 1 male bus. Board plus 3 connectors **$22.95.**

AIM65/KIM/VIM I/O Expansion Kit; 4 parallel and 2 serial ports plus 2 internal timers **$39.00.** PROM programmer for 2716 **$150.00.**

Multi-volt Computer Power Supply

8v 5 amp, ±18v .5 amp, 5v 1.5 amp, −5v .5 amp, 12v .5 amp, −12 option. ±5v, ±12v are regulated. Kit $29.95. Kit with punched frame $37.45, $4.00 shipping. Kit of hardware $14.00. Woodgrain case $10.00, $1.50 shipping.

PROM Eraser

Will erase 25 PROMs in 15 minutes. Ultraviolet, assembled **$37.50**
Safety switch/Timer version **$69.50**

60 Hz Crystal Time Base Kit $4.40

Converts digital clocks from AC line frequency to crystal time base. Outstanding accuracy.

NiCad Battery Fixer/Charger Kit

Opens shorted cells that won't hold a charge and then charges them up, all in one kit w/full parts and instructions. **$7.25**

LRC 7000+Printer $389.00

40/64 column dot matrix impact, std. paper. Interface all personal computers.

Televideo Terminal $845.00

102 key, upper, lowercase, 10 Baud rates 24 x 80 char. microprocessor cont. edit. cap.

Intertube II Terminal $874.00

Super Brain Floppy Disk Terminal $2895.00

79 IC Update Master Manual $29.95

Complete IC data selector, 2500 pg. master reference guide. Over 50,000 cross references. Free update service through 1979. Domestic postage $3.50. No foreign orders.

S-100 Computer Boards

8K Static RAM Kit	$135.00
16K Static RAM Kit	265.00
24K Static RAM Kit	423.00
32K Static RAM Kit	475.00
16K Dynamic RAM KIt	199.00
32K Dynamic RAM Kit	310.00
64K Dynamic RAM Kit	470.00
Video Interface Kit	**$129.00**

Video Modulator Kit $8.95

Convert TV set into a high quality monitor w/o affecting usage. Comp. kit w/full instruc.

Digital Temp. Meter Kit $34.00

Indoor and outdoor. Switches back and forth. Beautiful. 50" LED readouts. Nothing like it available. Needs no additional parts for complete, full operation. Will measure −100° to +200°F, tenths of a degree, air or liquid. Beautiful woodgrain case w/bezel **$11.75**

TERMS: $5.00 min. order U.S. Funds. Calif residents add 6% tax.
BankAmericard and Master Charge accepted.
Shipping charges will be added on charge cards.

FREE: Send for your copy of our NEW 1980 QUEST CATALOG. Include 28¢ stamp.

CIRCLE 184 ON READER SERVICE CARD

MICROCOMPUTER LITERACY COURSE

Educational Activities, Inc. announces sound-color filmstrip series that is a step-by-step course in basic microcomputer literacy. The program, Computer Programming: Basic for Microcomputers, was created to fulfill what Andrew R. Molnar of the National Science Foundation terms "a national need to foster computer literacy."

This series, which also includes a comprehensive Teacher's Handbook, was designed especially for the beginner. The teacher needs no prior computer knowledge to present the filmstrip series to students. $84.

Educational Activities, Inc., P.O. Box 392, Freeport, NY 11520.

CIRCLE 244 ON READER SERVICE CARD

Disk & Tape Systems

WINCHESTER BACKUP

A new backup for its Winchester disk has been announced by Corvus Systems. Called the Corvus Mirror, it employs a standard video cassette with a total capacity of 100 million bytes.

The Mirror interfaces the data signals on the Corvus disk to a separate customer supplied video cassette recorder of the VHS, Beta, or U-Matic format. If a larger data capacity is required, a reel-to-reel video-tape recorder can be used.

The Mirror uses the same Z-80 microprocessor and Corvus interface bus as the Corvus disk.

It will interface to a wide variety of host computers including the Apple, TRS-80 Model I and Model II, S-100, and LSI-11, plus all new computers interfaced to Corvus disks in the future. $790.

Corvus Systems, 900 S. Winchester Blvd., San Jose, CA 95128. (408) 246-0461.

CIRCLE 245 ON READER SERVICE CARD

QUICK-ACCESS DISK DRIVE

The Mikro-Disk 211 is a low-cost, quick-access disk drive based upon a Modified Winchester technology. It features an 8-inch diameter hard disk and a proprietary low-mass multiple head assembly that provides fast access to data (average access of 18 milliseconds).

The Mikro-Disc 211 has data access characteristics that suit it for systems that require high speed cache and mass store capability.

New World Computer Corporation, 3176 Pullman St., Suite 120/122, Costa Mesa, CA 92626. (714) 556-9320.

CIRCLE 246 ON READER SERVICE CARD

HARDTAPE SUBSYSTEM

Konan's DAT-100 single board controller will accommodate the DEI 15½ Megabyte (formatted) cartridge tape drive as well as the Marksman Winchester disk drive from Century Data.

The Hard Tape subsystem is available either as a complete tape and disk mass storage system or an inexpensive tape or disk subsystem. It supports FAMOS, CP/M version 2.0 and MP/M.

Konan Corporation, 1448 N 27th Ave., Phoenix, AZ 85009. (800) 528-4563.

CIRCLE 247 ON READER SERVICE CARD

CARTRIDGE DISK FOR TRS-80 MODEL II

Cameo Data Systems announces a TRS-80 Model II Adapter for the Cameo DC-500 Cartridge Disk Controller.

Used with a Cameo controller, the Adapter allows attachment of up to four 2½-20 megabyte cartridge drives, giving the Radio Shack machine a large database capability.

Removable cartridges facilitate multi-generation backup, needed to recover from program or operating errors, and can be used for archival storage as well. $1500.

Cameo Data Systems, Inc., 1626 Clementine St., Anaheim, CA 92802. (714) 535-1682.

CIRCLE 248 ON READER SERVICE CARD

NOT FOR CUCUMBERS EXCLUSIVELY

Terminals & I/O

PARALLEL TO SERIAL INTERFACE FOR SORCERER

The Sorcerer Parallel to Serial Interface is a totally self-contained unit which makes any RS-232 or 20mA printer look to the Sorcerer like a Centronics parallel line printer. With this unit you can throw away your delay loops and I/O drivers because you can use the line printer I/O drives that are already in your Sorcerer.

It has X-on,X-off and Data Terminal Ready handshaking, and will run at any of sixteen standard baud rates. $119.95.

Mark Longley, 2403 De La Cruz Blvd., Santa Clara, CA 95050.

CIRCLE 249 ON READER SERVICE CARD

ASCII KEYBOARDS

RCA has announced two "professional quality keyboards suitable for demanding environments." The VP-601 has a 58-key typewriter format and the VP-611 has the typewriter format plus a 16-key numberic keypad.

Both boards utilize flexible-membrane key switches which require only a light, but positive, pressure for activation, and feature fully encoded, 128-character ASCII alphanumerics.

They have a finger-positioning overlay and an on-board tone generator to give aural keypress feedback. The VP-601 is $65, and the VP-611 is $80.

RCA Cosmac VIP Marketing, New Holland Ave., Lancaster, PA 17604.

CIRCLE 250 ON READER SERVICE CARD

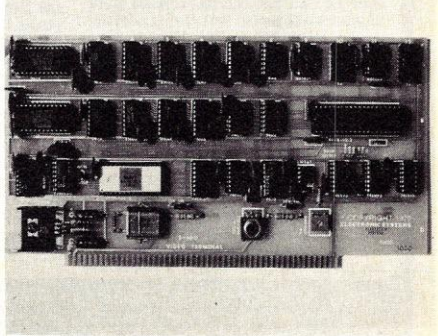
S-100 VIDEO TERMINAL BOARD

Electronic Systems announces an S-100 compatible Video Terminal Board in kit form. It includes upper and lower case, 5 x 7 dot matrix, serial RS-2132 in and out with TTL parallel keyboard input, and control characters.

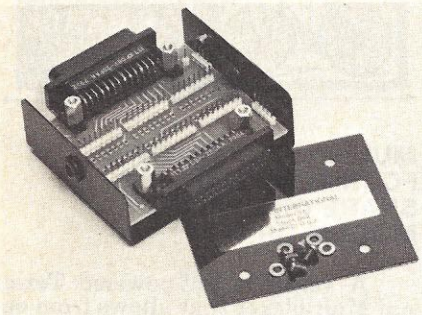
The addition of a keyboard video monitor or TV set with TV interface and power supply, claims the manufacturer, will make this a complete stand-alone terminal. $199.95.

Electronic Systems, PO Box 21638, San Jose, CA 95151. (408)448-0800.

CIRCLE 251 ON READER SERVICE CARD



CUSTOMIZED INTER-CONNECT OF RS-232 INTERFACES



The Remark Model 54 Stunt Box allows the user to customize interconnections between different RS-232 based devices. The Model 54 consists of a PC card containing two RS-232 connectors, one male and one female.

Frame ground, pin 1, is permanently connectly between connectors. Each of the remaining 24 connector pins from each connector is wired to a .025 in. square pin and a plated thru hole. This arrangement allows the use of wire-wrap or jumper pins on the posts to interconnect the signal paths while components can be inserted in the signal path between connector pins by soldering in place in the plated PC holes. $52.

Remark International, 4 Sycamore Dr., Woodbury, NY 11797. (516) 367-3807.

CIRCLE 252 ON READER SERVICE CARD

NUMERIC KEYPAD FOR TRS-80

Microcomputer Technology has announced a 16-key numerical key pad kit for the TRS-80.

Keys include 0 thru 9, (-), (/), (.), backspace and enter key.

The unit is completely wired and requires no soldering. It comes with complete instructions, key pad, cable, and a new plastic overlay for the TRS-80. $68.

Microcomputer Technology Inc., 2080 South Grand, Santa Ana, CA 92705. (714) 979-9923.

CIRCLE 253 ON READER SERVICE CARD

EIGHT SERIAL PORT BOARD BUS SOFTWARE

Trace announces its complete ESP+ System (Eight Serial Port board plus software). The ESP board is designed to provide large computer features for the S-100 bus. Included in the system is the TOPZ-80 operating system capable of supporting multiple tasks. The software is for use with the Z-80 microprocessor.

The ESP+ System includes an eight serial port board, up to eight 20K user areas, up to eight 24K system program areas, options to accommodate eight modems, two 32K memory boards, twelve digit extended multiuser Basic and CP/M compatible DOS. $2995.

Trace Electronics, Inc., 570 West DeKalb Pike, King of Prussia, PA 19406. (215) 265-9220.

CIRCLE 254 ON READER SERVICE CARD

NUMERIC KEYPAD FOR APPLE

California Micro Products announces a new product for the Apple II, the Multi-Function Numeric Keypad, Model KBAII.

The unit combines ten numeric keys and eight function keys: right/left cursor, minus, escape, slash, space, return, and period. No modifications to the Apple II are required.

Housed in a sloped-front enclosure with Apple II compatible color and texture, the keypad has a five-foot cable which allows positioning for operator convenience. $199.

California Micro Products, 795 W. Imperial Hwy., Brea, CA 92621. (714) 990-4014.

CIRCLE 255 ON READER SERVICE CARD

At last...
the typewriter interface!

Turn your electric typewriter into a low cost, high quality hard copy printer. 1 Year Warranty

The patented* RDI—I/O Pak is fast becoming the industry standard for typewriter output. Why? Because:

1. It takes 2 minutes to initially install and 5 seconds to remove or replace.
2. You *do not* have to modify your typewriter. All factory warranties and maintenance agreements on your typewriter will be honored.
3. You can use it with *all* powered carriage return typewriters that have U.S. keyboard. Our Model I works with all *non* Selectrics and our Model II works with Selectrics. Conversion between models takes 2 minutes and the kit (26 plungers) is available for a nominal charge.
4. You don't have to lug around a bulky printer when you travel. If there is a typewriter at your destination, you can install the light (3 lbs.) I/O Pak in just 2 minutes.
5. Same interface for TRS-80, Apple and GPIB. Centronics and Pet compatible interfaces are available in third quarter 1980. Electric pencil available.
6. Delivery: stock to 2 weeks: Price: $639.50, FOB Rochester, Domestic.

See your local distributor or call Bob Giese, 716 385-4336. In Europe, contact Capital Computer Systems, London 01-637 5551. We have the only "clean" approach to the typewriter/printer market.

*Patent Pending

ROCHESTER DATA

3100 Monroe Avenue, Rochester, New York 14618 incorporated

CIRCLE 190 ON READER SERVICE CARD

COLOR DISPLAY SYSTEM FOR TRS-80

Percom Data Company has announced the Electric Crayon, a computer-operated color graphics generator/controller.

Designed to generate color displays on either a TV set or monitor, the Electric Crayon includes its own ROM operating system, EGOS, which accepts single-character commands directly from a parallel ASCII keyboard or program-generated commands from a computer.

As shipped, the Electric Crayon interfaces with a TRS-80 computer, but it may be adapted for any computer. $249.95.

Percom Data Company, 211 N. Kirby, Garland, TX 75042. (800) 527-1592.

CIRCLE 256 ON READER SERVICE CARD

Peripherals

JOYSTICKS FOR OSI

Aurora Software Associates announces eight-directional joysticks for use with OSI home computers, including the new C4 and C8 models.

The joysticks feature a large fire button and may be plugged directly into most OSI computers. $24.95.

Aurora Software Associates, 353 S. 100 E. #6, Springville, UT 84663.

CIRCLE 257 ON READER SERVICE CARD

JOYSTICK INTERFACE FOR TRS-80

Creative Software has introduced a joystick interface for the TRS-80 computer. The joystick interface plugs directly into the expansion interface of the TRS-80 with no modifications.

Three sockets allow the use of one Fairchild or two Atari joysticks for single or two person interactive games and input. Both types of joysticks can sense eight compass directions.

The Atari includes one pushbutton and the Fairchild features push-pull and twisting actions. $65.

Creative Software, PO Box 4030, Mountain View, CA 94040.

CIRCLE 258 ON READER SERVICE CARD

CLOCK MODIFICATION FOR TRS-80

Mumford Microsystems has announced a clock modification for the TRS-80. The SK-2 3-Speed Mod is a small circuit board with five integrated circuits which may be mounted inside the keyboard unit or externally.

It interrupts the main clock line to the Z-80 and allows switching between normal speed, and a 50% decrease in CPU speed. $24.95.

Mumford Micro Systems, Box 435-A, Summerland, CA 93067.

CIRCLE 259 ON READER SERVICE CARD

UNION CYCLES
ANTI-VIBRATORY
PERFECT EASE
HIGH GRADE
CATALOGUE FREE
UNION CYCLE MFG.CO.
HIGHLANDVILLE MASS.

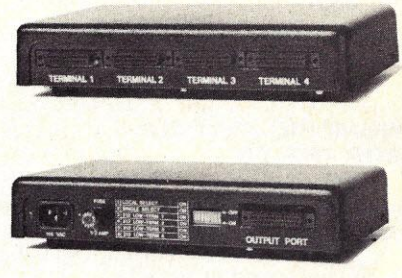
MULTIPLEXER ALLOWS FOUR TERMINALS TO SHARE ONE PRINTER, MODEM OR CPU

A versatile self-powered Terminal Multiplexer that allows from one to four RS232 terminals to share one printer, modem or CPU without unplugging cables is now available from Western Telematic.

Designated Model TM-41, the unit provides the following DIP switch selectable operating modes: an equal priority lockout mode so the user can activate just one port at a time; a local mode that allows an "OR" condition of all four input ports; and a multiple mode that activates any of the ports at the same time. In addition, a speed select mode allows each port to be programmed to automatically switch speeds on a 212 Modem. $295.

Western Telematic Inc., 2435 S. Anne St., Santa Ana, CA 92704. (714) 979-0363.

CIRCLE 260 ON READER SERVICE CARD



MICRO COMPOSER™
Designed by Hal Chamberlin and MicroTechnology Unlimited for the folks at M.M.I. and You!

Great Fun! The Micro Composer comes complete with an instruction manual, software disk or cassette — in either Integer or Applesoft ROM BASIC, and the MICRO MUSIC DAC music card. Just plug the MICRO MUSIC DAC into the APPLE extension slot and connect the audio cable to a speaker. NO AMPLIFIER NEEDED

- PLAY UP TO 4 SIMULTANEOUS VOICES!
- ENTER MUSIC NOTES BY A FAST SIMPLE, WELL-TESTED CODING SYSTEM.
- PROGRAM THE PITCH, RHYTHM, AND TIMBRE OF THE MUSIC. TEMPO IS VARIED BY THE APPLE PADDLE.
- COMPOSE, EDIT, DISPLAY AND PLAY MUSIC THROUGH AN INTERACTIVE, COMMAND-DRIVEN LANGUAGE.
- SAVE YOUR MUSIC ON DISK OR CASSETTE.
- EACH VOICE SOUND CAN BE CHANGED TO REED, BRASS, STRING OR ORGAN!

$220.

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07444
OF NEW JERSEY
MASTER CHARGE AND VISA ACCEPTED
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*APPLE II is a registered trademark of Apple Computer, Inc.

CIRCLE 125 ON READER SERVICE CARD

DOES YOUR COMPUTER SOMETIMES COUGH, SNEEZE OR HAVE A SEIZURE?

It may be suffering from Transiet Glitchitis, a cureable digestive disorder. The Blitz Bug can bring fast relief from these symptoms in less than 50 nano seconds. Available without prescription. Use only as directed.

* No Computer Should Be Without One *

Blitz Bug protects your entire circuit, and plugs into any outlet.
$19.95, Two for $35.00
N.J. Residents add 5% sales tax
Add $1.50 shipping&handling delivery from stock

Omni Communications Co., Inc.
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CIRCLE 174 ON READER SERVICE CARD

INTRODUCING HEWLETT-PACKARD'S HP-41C. A CALCULATOR. A SYSTEM. A WHOLE NEW STANDARD.

The new HP-41C from Hewlett-Packard is a powerful programmable calculator that features: an LCD display with alphanumeric capability; 63 registers of data storage or up to 400 lines of program memory—expandable to 319 registers or up to 2,000 program lines; up to 6 levels of subroutines; 10 conditionals and 56 internal flags; specific loop control; indirect addressing; local and global branching; Continuous Memory; RPN logic.

And when you need them: Memory Modules—plug-in modules for storing programs and data; an "extra smart" Card Reader; a Printer that prints upper and lower case alpha plus special characters and does high resolution plotting; the Wand to input programs in bar code form (available early 1980); Application Modules—preprogrammed, plug-in modules that give solutions to a wide range of problems.

The HP-41C lets you reassign any standard function, any programs you've written, or programs provided in the Application Modules—to any keyboard location you want. And of course Hewlett-Packard backs the HP-41C with total software support including an Owner's Manual and thousands of programs in the HP-41C Applications Pacs, Solutions Books, and the HP Users' Library.

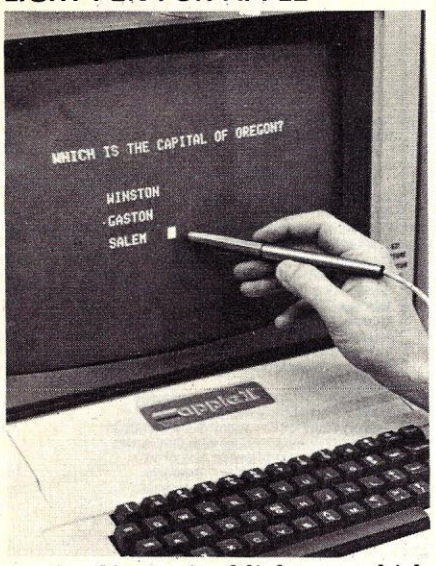
Experience this remarkable instrument. The new HP-41C from Hewlett-Packard. A calculator. A system. A whole new standard.

1) Memory Modules
2) The Printer

the computer corner
White Plains Mall, 200 Hamilton Ave.
White Plains, N.Y. 10601
(914)WHY-DATA.

CIRCLE 126 ON READER SERVICE CARD

LIGHT PEN FOR APPLE



A self-contained light pen which plugs directly into the Apple has been announced by the 3-G Company.

The 3-G Light Pen makes it possible to bypass the Apple's keyboard and interact directly with the information displayed on the CRT screen.

A "menu" can be displayed on the screen and the user can make a selection from that menu by using the light pen.

The Light Pen is completely assembled and ready to plug into the Apple game paddle port. A demonstration game cassette, sample program and complete programming instructions are included with the pen. $32.95.

3G Company, Incorporated, Rt. 3, Box 28A, Gaston, OR 97119. (503) 662-4492.

CIRCLE 261 ON READER SERVICE CARD

DIRECT CONNECT MODEM

Modtech, Inc. announces the M103, a FCC approved direct connect modem.

The M103 is an originate only modem compatible with the Bell 103/113 data sets which plugs directly into the telephone network using the conventional RJ11C modular phone jack or DAA.

It connects to any terminal with an RS232 or 20ma interface and operates at a maximum data rate of 450 bps over ordinary telephone lines. $185.

Modtech, Inc., 1958 Helsinki Way, Livermore, CA 94550. (415) 447-9349.

CIRCLE 262 ON READER SERVICE CARD

SUPERPASCAL

5-10 times faster... and more!

Meet Pascal/Z,™ the fast, flexible compiler with higher speed, greater efficiency and improved debugging.

- **True Z-80 native code Pascal compiler**—5-10X faster than competing P-code implementations—*no interpreter required.*
- **The only multi-tasking Pascal**—produces ROMable re-entrant code.
- **Optimized** for fastest execution—recognizes and exploits special cases.
- **Easily transportable**—all hooks to your system made through support library.
- **Includes standard** floating point package. Single copy on CP/M-compatible disk includes compiler, companion macro-assembler & source of the library, $395. OEM licenses available. Write or call for more information.

InterSystems™

Ithaca Intersystems Inc., 1650 Hanshaw Road/P.O. Box 91, Ithaca, NY 14850/607-257-0190/TWX: 510255 4346

CIRCLE 153 ON READER SERVICE CARD

©1979 Ithaca Intersystems Inc

ASCII keyboards: parallel or serial output, as low as $69.*

RCA VP-600 series ASCII keyboards are available in two formats. You can choose either a 58-key typewriter format. Or a 74-key version which includes an additional 16-key calculator-type keypad. Both can be ordered with parallel or serial output.

These keyboards feature modern flexible membrane key switches with contact life rated at greater than 5 million operations. Plus two key rollover circuitry. A finger positioning overlay combined with light positive activation key pressure gives good operator "feel," and an on-board tone generator gives aural key press feedback.

The unitized keyboard surface is spillproof and dustproof. This plus high noise immunity CMOS circuitry makes these boards particularly suited for use in hostile environments.

Parallel output keyboards have 7-bit buffered, TTL compatible output. Serial output keyboards have RS 232C compatible, 20 mA current loop and TTL compatible asynchronous outputs with 6 selectable baud rates. All operate from 5 V DC, excluding implementation of RS 232C.

For more information contact RCA Customer Service, New Holland Avenue, Lancaster, PA 17604.
Or call our toll-free number: 800-233-0094.

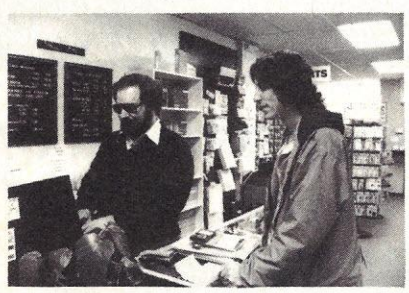
RCA

*Optional user price for VP-601. Dealer and OEM pricing available.

CIRCLE 188 ON READER SERVICE CARD

The creative computing Computer Store of the Month

Hundreds of computer stores sell Creative Computing Magazine, Press books and software nationwide. We believe that the contributions made by these stores to their communities should be recognized and applauded. In this and future issues of Creative Computing Magazine, we'll spotlight some stores which deserve attention for their salesmanship, creativity and community service.



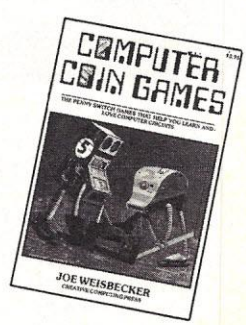
John and Marilyn Clark opened Data Domain in Schaumburg, Illinois, a suburb of Chicago, in 1977. Their original stock was limited to a few computers and "miscellaneous parts." Today John and Marilyn sell and support the Apple, Alpha-Micro and Hewlett-Packard lines as well as a selection of over 800 book titles -- perhaps the largest in the country.

Store policy is committed to full support to all lines in terms of service, software and "good old-fashioned help." John Clark feels that a large measure of the store's success has to do with its attitude toward customers. "There are no dumb questions a customer can ask. Our customers range from novice to professional. We take the time to try and help them all."

Data Domain sells Creative Computing Magazine, Press books and software. If you're in the Chicago area, you might want to stop in. They're located at 1612 E. Algonquin Road, Schaumburg and you'll find them open on Tuesday through Friday from 12 to 9 and on Saturdays from 11 to 5. Or call them at 312/397-8700.

Pick it up at your local computer store!

Computer Coin Games



Games Magazine said, in a recent issue: "A collection of games, puzzles, and experiments with simple rules and full size playing boards make this little book an entertaining and educational guide to the nature of binary numbers and computer circuits. Whether or not you have any experience with computer technology, you'll be both amazed and delighted by the simplicity of the format and the complexity of the play...all you'll need is some common cents."

Joe Weisbecker's Computer Coin Games is on sale at Data Domain and many other computer stores. If it's not in your area yet, send $3.95 plus $1.00 shipping and handling to Creative Computing Press, Dept. CCD, P.O. Box 789-M, Morristown, NJ 07960. For faster service, call our toll-free hotline 800-631-8112 (in NJ call 201/540-0445).

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THE SMARTEST COMPUTERS AT THE SMARTEST PRICE
QUAD & DOUBLE DENSITY

	List	Only
Horizon-1-32K-D Kit	1999	1585
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Assembled & Tested	2765	2195
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TEI PT 212 Computer 5 MHZ	8000	6250
Thinker Toys Discus/2D A&T	1149	949
Discus/2+2 1.2 Megabytes A&T	1549	1299
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Intertube II Smart Terminal	995	745
Microtek Printer	750	675
Anadex Printer	995	875
Florida Data Printer 600 CPS	4300	Call for Price
Maryellen Word Processor	Your Best Buy	38
Textwriter III		125
EZ-80 Tutorial Learn Machine Language		25
PDS for North Star Better than CP/M		99
Compiler for Horizon Secret Superfast Code		100
10% Off Software Prices with Computers		
Verbatim the Best Diskettes Box of 10		29
Which Computers Are Best? Brochure		Free
North Star Documentation Refundable w/HRZ		20

AMERICAN SQUARE COMPUTERS
KIVETT DR* JAMESTOWN NC 27282
(919)-883-1105

CIRCLE 107 ON READER SERVICE CARD

FREE! up to $170. in merchandise with purchase of PET-CBM item!!!
FREE MERCH

PET 16K Large Keyboard	$ 995	$130
PET 32K Large Keyboard	$1295	$170
PET 8K Large Keyboard (New)	$ 795	$100
PET 2040 Dual Disk (343K)	$1295	$170
PET 2023 Printer (pres feed)	$ 695	$ 70
PET 2022 Printer (trac feed)	$ 795	$100

KIM-1 $159 (Add $30 for Power Supply) SYM-1 $ 209.00
AXIOM EX-801 Printer-PET ..... $ 477.00
2114 L 450 ns 5.35 24/4.95 100/4.45
2716 EPROM (5 Volt) 29.00
6550 RAM (for 8K Pet) 12.70
PET 4 Voice Music System (KL-4M) 34.50
All Books and Software ..... 15% OFF
Leedex Video 100 12" Monitor 119.00

ATARI — INTRODUCTORY SPECIAL
ATARI 400, Atari 800, and all Atari Modules 20% OFF.

Heath WH-19 Terminal (fact. asm.) 770.00
Programmers Toolkit - PET ROM Utilities 44.90
PET Word Processor - Machine Language 24.00

SALE

3M "Scotch" 8" Disks	10/31.00
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Verbatim 5" Disks	10/26.50
Disk Storage Pages	10/ 3.95

Cassettes (all tapes guaranteed) Premium quality, high output low noise in 5 screw housing with labels. AGFA PE 611

C-10	10/5.95	50/25.00	100/48.00
C-30	10/7.00	50/30.00	100/57.00

Add $1 per order for UPS shipping.
Ask for 6502, TRS-80, and S-100 Product List.

A B Computers
115 E. Stump Road
Montgomeryville. PA 18936
(215) 699-8386

CIRCLE 103 ON READER SERVICE CARD

PET - Most BASIC Computers - TRS80

SORTS

Designed for the small computer owner
Matched to the type of data to be sorted

VERY FAST - EASY TO USE - VERY SHORT

Compare! Sorting 100 items into 31 categories
(Bubble sort uses over 180 seconds)

Our SCN Sort takes only 6 seconds!

Generate Sorted List or Index List
Ascending or Descending Order

Original List	Sorted List	Index List
OL$(1) = "B"	SL$(1) = "A"	IL(1) = 2
OL$(2) = "A"	SL$(2) = "B"	IL(2) = 1
OL$(3) = "C"	SL$(3) = "C"	IL(3) = 3

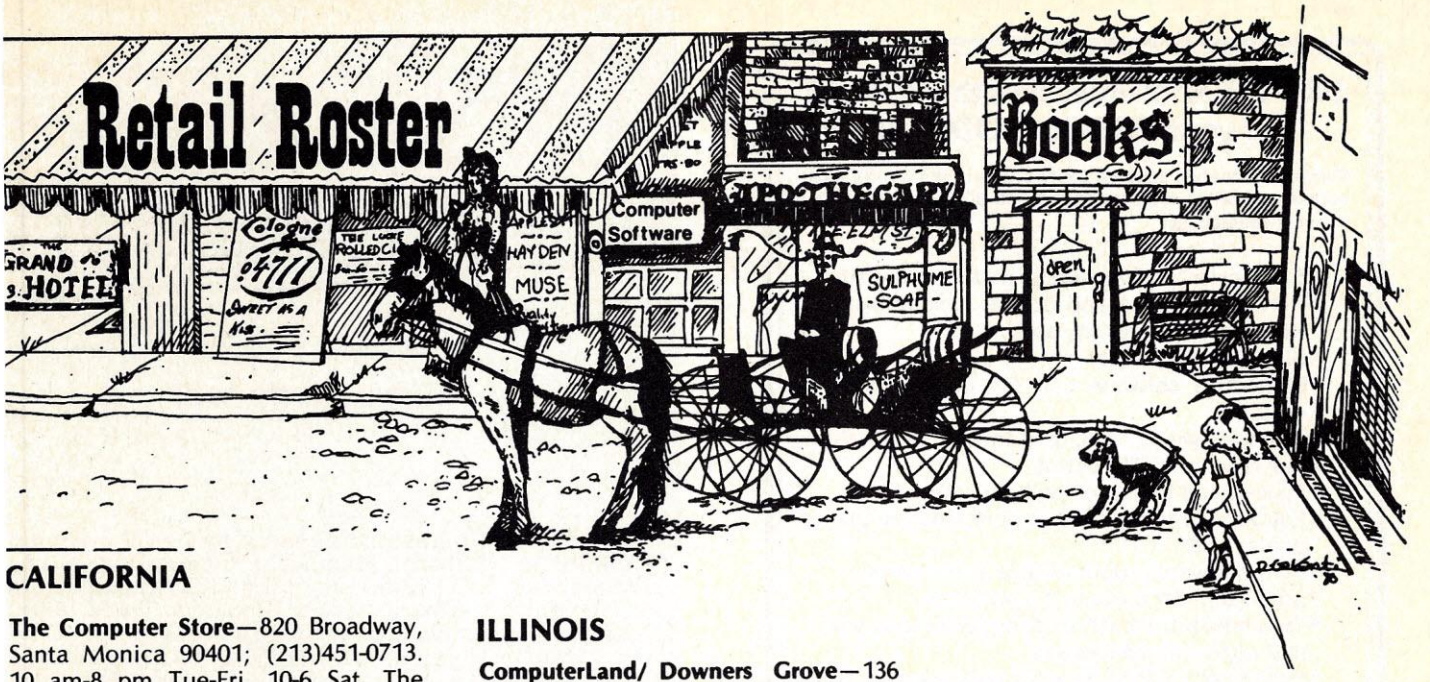
Add to your program in less than 5 minutes

SCN -Fastest for Numeric characters	$3.95
SCA -Fastest for Alphanumerics	$3.95
SCMC-For multiple character sorts	$4.95

Order any 2 packages for $5.95
All 3 for $7.95

G E Enterprises
1417 11th St., Manhattan Beach, CA 90266

CIRCLE 144 ON READER SERVICE CARD



CALIFORNIA

The Computer Store—820 Broadway, Santa Monica 90401; (213)451-0713. 10 am-8 pm Tue-Fri, 10-6 Sat. The Original One! Apple/Vector Graphic.

D.E.S. Data Equipment Supply—8315 Firestone Blvd, Downey 90241; (213) 923-9361. 8AM-9PM 7 days. Complete computer facility—Commodore Pet dealer—"$olid Gold $oftware®" specialists.

PC Computers—10166 San Pablo Ave, El Cerrito 94530; (415) 527-6657. 9-5:30 Mon-Sat. Commodore Pet, Compucolor and Atari.

CONNECTICUT

The Computer Store—63 S. Main St, Windsor Locks 06096; (203) 627-0188. 10-6 MTWF, 10-8 Thu, 10-4 Sat.

Computerworks—1439 Post Rd. East, Westport 06880; (203)255-9096. 12-6 Mon-Sat, 12-9 Thu.

FLORIDA

AMF Electronics—11158 N. 30th St, Tampa 33612; (813)971-4072. 10-6 Mon-Sat. Apple Computer Sales & Service; TRS-80, Apple Software & Peripherals; S-100 boards, computer parts & books.

GEORGIA

Atlanta Computer Mart—5091 Buford Hwy, Atlanta 30340; (404)455-0647. 10-6 Mon-Sat.

To include your store in Creative Computing's Retail Roster, call the Advertising Department at (201) 540-9168.

ILLINOIS

ComputerLand/ Downers Grove—136 Ogden Ave, Downers Plaza 60515; (312) 964-7762. 10-6 Mon-Sat, 10-8 Tue, Thu.

Data Domain of Schaumburg—1612 E. Algonquin Rd, Schaumburg 60195; (312) 397-8700. 12-9 Tue-Fri, 11-5 Sat. Largest book & magazine selection.

Farnsworth Computer Center—1891 N. Farnsworth Ave, Aurora 60505; (312) 851-3888. 10-8 Mon-Fri, 10-5 Sat. Apple, Hewlett-Packard, Cromemco, HP calculators, IDS-440G printers.

KENTUCKY

ComputerLand of Louisville—10414 Shelbyville Rd, Louisville 40223; (502) 245-8288. 10-5:30.

MASSACHUSETTS

NEECO—679 Highland Ave, Needham 02194; (617) 449-1760. 9-5:30 Mon-Fri. Commodore, Apple, Superbrain, TI99/4.

Science Fantasy Bookstore—18 Eliot St, Harvard Sq, Cambridge 02138;(617)547-5917. 11-5 Mon-Sat, 11-8 Thu. Apple Games:Shuttle-Adventure Invader.

MICHIGAN

Computer Mart—560 West 14 Mile, Clawson 48017; (313)288-0040. The Midwest's largest computer store! (We will not be undersold!!)

NEW HAMPSHIRE

Computer Mart of New Hampshire—170 Main St, Nashua 03060; (603) 883-2386. 10-5. Dental-medical computer specialists, Data General & Apple systems.

NEW JERSEY

Computernook - Rt. 46, Pine Brook Plaza, Pine Brook 07058; (201)575-9468. 10-6:30 MTWS, 10-8 Thurs., Fri. Apple/ Commodore Authorized dealer.

NEW YORK

The Computer Corner Inc—200 Hamilton Ave, White Plains 10601; (914)WHY DATA. 10-6 Mon-Sat, 10-9 Thu.

OHIO

The Basic Computer Shop—2671 W. Market St, Akron 44313; (216) 867-0808. 10-6 Mon-Sat.

Micro Mini Computer World, Inc. - 74 Robinwood Ave., Columbus 43213; (614) 235-6058, 5138. 11-7 Tue.-Sat. Authorized commodore dealer - Sales/ Software/Service/Support.

PENNSYLVANIA

Personal Computer Corp.—24-26 W. Lancaster Ave, Paoli 19301; (215) 647-8643. 10-6 Mon-Fri, 10-8 Wed, 10-5 Sat.

VIRGINIA

ComputerLand/ Tysons Corner—8411 Old Courthouse Rd, Vienna 22180; (703) 893-0424. 10-6 MTWF, 10-9 Thu, 10-5 Sat.

Computers Plus, Inc—6120 Franconia Rd, Alexandria 22301; (703) 971-1996. 10-9 Mon-Fri, 10-6 Sat. Micro specialists, books, classes, software, maintenance. "The PLUS makes the difference."

P&T CP/M® 2 unleashes the POWER of your TRS-80 MODEL II

Pickles & Trout has adapted CP/M 2, one of the world's most popular operating systems, to the TRS-80 Model II and the result is spectacular:

- 596K bytes usable storage at double density
- Runs both single and double density disks with automatic density select
- Single drive backup
- Multi-drive software can run on a 1 drive system
- Operates with 1, 2, 3, or 4 drives
- Full function CRT control
- Type-ahead buffer for keyboard input
- Full access to both serial ports and parallel printer port
- Fully software programmable serial ports
- Loads an 18K Basic in 2.5 seconds
- Full compatibility with existing CP/M software and application packages
- Full set of 7 CP/M manuals plus our own for the TRS-80 Model II

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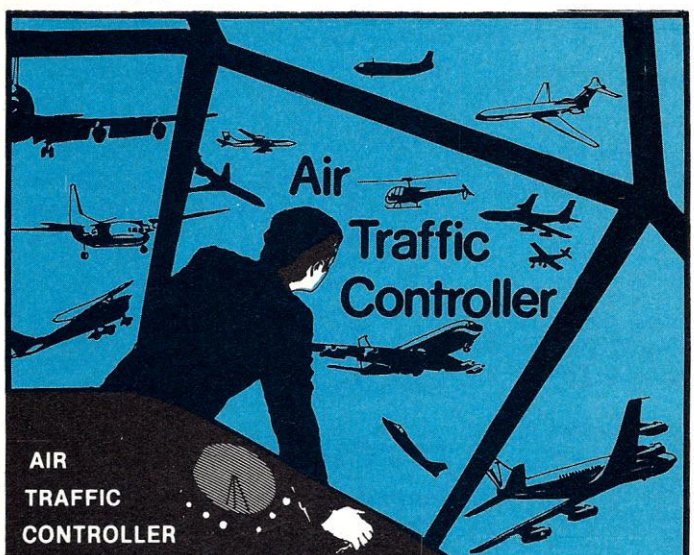

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Intelligent Computer Products, by Tom Manuel and James H. Gibbons. Magnacon Corporation, Santa Clara, CA. 250 pages, paperback. $575 (extra copies $50.00). 1979. (Distributed by Electronic Trend Pubs., 10080 N. Wolfe Rd., Cupertino, CA 95014).

What can you do with $575? If you have a very urgent need to know you could buy a copy of this report on microprocessor technology and its future. The report begins with a discussion of hardware at the chip level, including 16-bit and single-chip microprocessors and support components. Other sections cover market trends and expectations, software engineering and requirements for product success. The scope of the report is very wide but there is a little confusion as to whom the report is addressing. The section on technological trends and expectations seems to be talking to a very technically sophisticated reader, in discussing processor architectures and instruction sets, while at other times the report is clearly targeted at a marketing or planning expert whose concern with the particulars of microprocessor-based hardware is purely secondary.

In comparison with most books on microprocessor technology, this report gives the reader a much better idea of where the industry is going, how the different microprocessors stack up against each other, and how they might be used in successful products, without getting bogged down in unimportant details. It would be difficult to find all this information presented with this clear perspective anywhere else. Whether or not it is worth $575 to you is your decision. —SN

Calculus and the Computer by Timothy Fossum and Ronald Gatterdam. Scott, Foresman and Company, Glenville, IL. 220 pages, paperback. 1980.

This student textbook very successfully integrates the use of a Basic-speaking computer with the teaching of calculus. The text is written to be used much like a laboratory manual, as a supplement to a regular classroom text. In each of the 21 lessons the book presents an annotated Basic program, with a discussion of the theory behind its operation and student exercises (involving running the program with different data, modifying the original program and writing new programs). The lessons emphasize an understanding of concepts and seem designed to avoid blind use of canned software, but the text does not attempt to teach programming (and rightfully so since the focus here is on mathematics.) Some of the lessons include root finding, numerical integration, arc length and power series. Flowcharts are given to ease implementation of the algorithms in other languages. The level of the text is first-year college calculus with a few more advanced supplementary sections. This is an excellent resource for teaching calculus with the computer as an active participant. —SN

You Just Bought A Personal What? by Thomas Dwyer and Margot Critchfield. Byte Books, Peterborough, NH.

Dwyer and Critchfield have done it again.

Last time, it was **Basic And The Personal Computer,** a $12 softbound that seemed expensive only until its contents revealed that it was worth a sagging bookcase of Basic texts. It seemed unlikely, in fact, that anybody would produce a work of quality adequate to share shelf space with it.

Nobody did 'til now. **You Just Bought A Personal What?** lives up to the standard. Though quite a different book, it recalls all the style and *joie d'comput'* of the earlier work. In fact, it's hard to put it down in the same sense that you might say that of good fiction. And while generally within mind's reach of the young reader, it doesn't pander. It provides both a point of entrance and an entertaining pace for all comers — computing waif and old-timer alike.

The authors have sub-titled the book "A **Structured** Approach to **Creative** Programming." Both key words are on target. The book's greatest favor to those it will bootstrap into programming is that from the first 5-line program through the superproject at the end (a challenging wordprocessor program), it gently champions the discipline of a top-down structured approach. That opens the door to the creative dimension by showing that creativity in Basic programming is genuinely easy once you've been charmed away from the shackles of confusion that weigh upon the programmer who spends more time typing his programs than thinking them through.

For the grizzled veteran of three or four years of personally reinventing the art of programming, there's catch-up. Seduced by the style, these culturally deprived souls will find themselves chewing a tasty dessert of new vocabulary, new conceptual understanding and computing history.

In 4+ chapters (5½, actually), this book moves from the rudiments of getting started through a process of learning from games and then applying that knowledge to more "serious" purposes and, finally, to what's needed to "upgrade." Chapter five, really an appendium, consists of program listings that leave no doubt about Dwyer and Critchfield having actually worked through their own examples. And as they observe, programs can be used as is, or (hopefully) as the undergirding of reader inventions.

Personal What? is oriented to the TRS-80 and Microsoft Basic. Other authors have made the mistake of trying to be machine-independent and Basic dialect-independent to the point of being vague — and leaving far too much to the reader to puzzle through when a clarifying example in **any** dialect would help a lot. Critchfield and Dwyer wisely recognize that a book targeted to the Microsoft Basic user and the TRS-80 owner is made more useful to all readers, even those who may never touch the keyboard of a Radio Shack machine but can read, understand and appreciate clear and complete programs.

Like its forerunner, **You Just Bought A Personal What?** is now a **must** for the beginning microcomputerist, and a definite plus for the old hand.

— Dick Lutz

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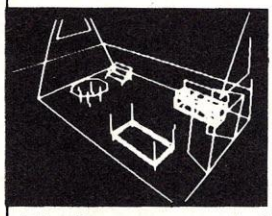

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The Datasearch Guide to Low Capital, Startup Computer Businesses. Author not stated. Published by Datasearch Inc., Memphis, TN (1977). 156 pages, paperback $20.00, money-back guarantee.

This "guide" is intended to provide the would-be computer entrepreneur with ideas for possible business ventures. Most of these businesses can be started with little money, and most can be carried out on a part-time basis or moonlighting basis.

The book starts with a 4-page pep talk on "Your Own Company," and follows this with a 3-page dissertation on the myriad virtues of moonlighting and about 100 pages concerned with "25 low capital opportunities" (though I counted only 24). Chapters on letter writing, selling to the computer industry, how to decide if you really want to "go solo," and financing your business round off the volume.

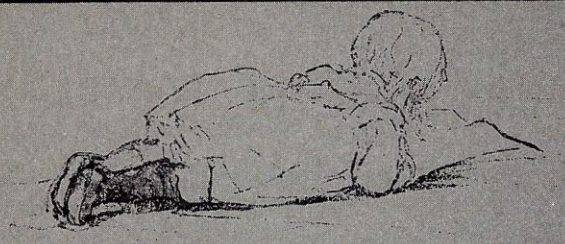
The various types of ventures suggested include consulting, freelance writing, seminars, headhunting, used computer sales, professional service brokering, publishing one's own books,finder's fees, scrap supplies and components, computer time brokerage, software packages, contract programming, tape and disk cleaning, computer output microfilm services, lease brokerage, computer portraits and promotional newsletters. "Computers in the house" and microprocessors in general are dealt with next, followed by five areas of "vendor dependent" businesses. The latter include third party field service, independent sales representatives, computer supplies, hardware distributorships and systems houses.

The author of the **Guide** would probably agree that none of the ideas suggested is novel; many businesses of each kind already exist. But the book was not designed as an inventory of inventions; it is intended for the reader seeking information about the pros and cons of possible business ventures. On the whole, this information is provided fairly and objectively, though sometimes a little too briefly. In particular, though warnings about potential difficulties are provided in many places, the book is generally very optimistic in tone concerning the likelihood of success. Having set up businesses for myself and for clients, and worked with numerous one and two person ventures, I am aware that most such businesses are a lot more demanding and a lot less financially rewarding than a straight 9-to-5 job might be. The **Guide** does mention this, but not often enough nor strongly enough. Readers could be led astray by the apparent ease and rich rewards of some of the business suggestions proposed. Yes, it is true that a lot of people are making a lot of money in the computer field — but if this were as easy as the **Guide** sometimes makes it seem then businesses of this sort would be "coming out of the woodwork." And there would not be the steady stream of bankruptcy actions and "reorganizations" suffered even by businesses a lot larger than those the book is concerned with.

The person who wants to go into business will need to work hard — and may well have to persevere through long "lean" periods. As the book does point out, "moonlighting" or "adding a sideline" to an already existing job may therefore be the most satisfactory way for the majority of people to go. This will provide an income to house, feed and cloth the entrepreneur and dependents while the new venture is getting on its feet. It may also provide access to contacts or customers for the "sideline" business to grow on.

The "president" of a one-person company is also the entire production crew, office staff, salesforce and everything else. The only guarantee such a person has is that he or she will have to do everything that must be done, or it won't get done. Those of us who cannot just write a check to cover equipment, supplies, inventory, staff, salespeople and a long list of et ceteras had better be prepared to invest thousands of hours instead of thousands of dollars in making the business successful.

Had the **Guide** stressed this more — pointing out



that 80-100 hour work weeks are the rule rather than the exception for serious moonlighters and other entrepreneurs — its major deficiency of context would have been eliminated.

The other major fault of the **Guide** is poor quality control. The book was offset printed from typewritten originals; the print on many pages was an unhealthy pale grey instead of a crisp black. On my copy, too, the plastic strip binder had opened about one-third of its length because of faulty sealing. (This seems to be a Velo-Bind R type of binding, with two thin plastic strips outside the spine of the book. Personally, I find these bindings clumsy and inconvenient. A wider margin to accommodate a 3-hole punch would have been preferable.) In addition, there are numerous typos and misspellings.

On the whole, however, the book is sound in content and very readable. Aside from the over-enthusiasm already noted, the essential nature of each endeavour is stated fairly. Reasonable accounts are presented concerning the kinds of skill or knowledge required and, in most cases, many helpful hints are provided. This is definitely a good place for the would-be entrepreneur to start. At $20, the price is rather high for so few pages, but perhaps not too high when considered as a business investment. — Cyril Solomons, Ph.D.

How to Package and Market Your Own Software Product — And Make it GO! No author indicated. Published by Datasearch Inc., Memphis, TN (1978). Looseleaf in 3-ring binder, 182 pages, $45.00, money-back guarantee.

This publication packs 25 chapters into 182 typescript pages. The best summary of its purpose is provided in the Introduction:

> "The guide assumes that you have a piece of software, written and reasonably debugged and documented. From this point we'll pick up and cover how to polish it up, turn it into a finished product and hopefully a money-maker."

This volume concentrates in detail on one potential area of computer business for the moonlighter or entrepreneur. To provide encouragement to such a software entrepreneur, the lead-in chapter focuses on the potential market. With total software sales currently running about one billion dollars a year, the message comes through loud and clear that there is plenty of opportunity — all the way down to lucrative pickings for "the one-person shop."

The next three chapters then discuss why users buy "ready-made" packages, what they look for and how to set up user contracts (including a sample). These are followed by three chapters dealing with types of software for which there is a potential market, ways in which microcomputer software might be exploited and how to perform market research for a new software product. This last area is one which most beginners should find instructive.

The longest chapter in the book (69 pages) is entitled "29 proven ways to reach your markets." These include trade shows, seminars, audio/visual presentations, demos, ads, direct mail and associations, to name just seven. Actually, not all 29 sections are specific marketing techniques. Section 1 deals with the

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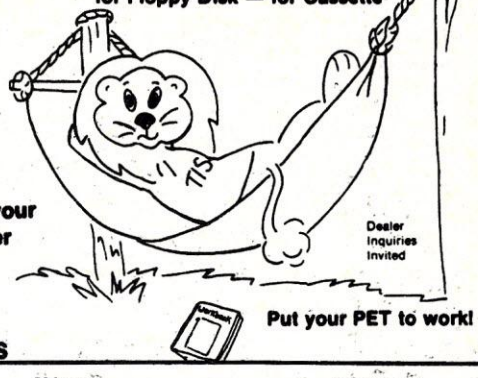

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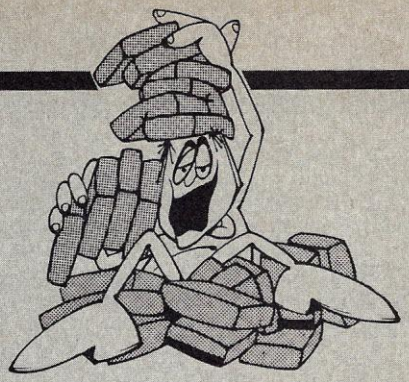
qualification of prospects, while Section 20 makes a very good plea for the avoidance of technical buzzwords. But most newcomers to the business will find at least a few techniques they had not already thought of. There are also good words of advice, in most cases, even on ideas that had already come to mind.

Six chapters deal with various aspects of the use of salesmen, sales representatives and other outlets. Specific sales techniques are covered, followed by chapters on legal issues ("taxes and protection") and financing the business, before embarking on an additional four chapters on various aspects of selling and marketing. The final two chapters list software distributors and brokers, and marketing aids and services, respectively.

I think it would be unfair to this publication to compare it with conventional books, whether hard-bound or softcover. It is, in fact, an entrepreneurial effort in publishing akin to the software efforts it describes. Quite obviously — especially since on page 156 the author tells how it was done — the manual (as he calls it) "was laid out on an IBM Selectric and produced in quantity on our offset printing equipment."

This homebrew approach results in a number of rough spots. The printing is a bit weak in places, for example, though no page was so lightly inked as to be difficult to read (unlike some pages of the **Guide,** above). There are also many misspellings and typographical errors that would have been caught (we can hope) by professional editing.

On the positive side, however, this manual has a lot going for it. Most software people are not sufficiently familiar with the details of marketing or salesmanship to be able to do justice to their products. Books on marketing or salesmanship, on the other hand, do not



address themselves to computer software and its unique problems. This is the only work I know of which combines these two fields. For such people there are three options: locate a marketer/salesperson who can do this part of the job for them (they hope); try to do it without help, themselves (and hope even harder); or obtain and study this manual to provide the help.

As is the case with most guides of this kind, nothing is really original. Anyone on the marketing/sales side of business is likely to read through the 182 pages and say "I learned all that 10, or 20 (or whatever), years ago." The point of the book is that computer entrepreneurs did not learn these things years ago, and need this information and guidance. A software producer may work with a seasoned marketing representative or sales representative who knows what he or she is doing, and can be trusted to do it (no easy find according to the book). This will take a load off the producer, but guidance is still needed on how to work properly with the rep and get maximum benefit out of the arrangement. Thus, even if marketing is handled by someone else, the software producer needs to know how it ought to be done, to make sure it actually is done. For a lot of new software producers, getting expert help is going to be even more of a hassle than doing it themselves — unless they just sell all their rights — so they will need to use what they learn from the book.

I think the best parts of the book for the entrepreneur are those providing warnings, or advice on what not to do. Obviously, no "do it yourself" book such as this can really tell the reader what to do in order to become rich and famous in the software industry. But with a bit of advice the beginner might well avoid frustrating and expensive errors — whether of commission or omission. The author's experience as a software rep really shows, for example, in the chapter on marketing representatives and salesmen. Even here — in his own field, where most software producers will be on totally unfamiliar ground — the author cannot provide a check list of, say, 5 or 10 things to do to guarantee success. But the things he tells the reader could (if taken to heart) help avoid hiring a poor salesman, contracting with a mediocre rep, or souring a good one through mistreatment.

This book, therefore, compensates to a large extent for the over optimistic attitude expressed in **The Datasearch Guide to Low Capital, Startup Computer Businesses.** This is not to say that the book fails to provide positive advice. It does. A lot. The point is that, in this reviewer's opinion, the negative advice provided is even more valuable. Novices to marketing could easily spend hundreds of dollars on a booth at the wrong computer show, advertise in the wrong journal, or advertise in the wrong way. Though high, the price of the manual ($45) is not excessive when viewed as insurance against such expensive mistakes. (The publisher makes the decision of whether or not to buy even easier by offering a 30-day trial period with money-back guarantee). Whether for the insurance or for positive advice on such diverse matters as sending out news releases, writing sales letters, setting priorities on contacting prospects, or making sales presentations, this manual deserves to be required reading for the would-be software marketing entrepreneur. It will not work miracles; a good software product will still be needed, and a lot of hard work will still need to be done, but it should help. — Cyril Solomons, Ph.D.

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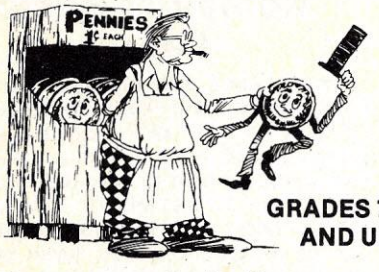
The book includes many activities that don't require a computer. And if you're considering expanding your computer facilities you'll find the section on how to select a computer complete with a microcomputer comparison chart invaluable.

Much of the material has appeared in **Creative Computing** but the back issues are no longer available. Hence this is your only source to this practical and valuable material. Edited by David H. Ahl,this mammoth 224-page softbound book costs only $15.95. (The individual issues, if they were available, would cost over $60.00). [12D]



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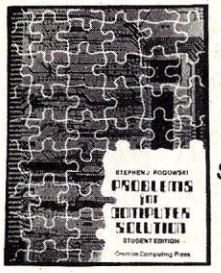

Problems for Computer Solution

Stephen J. Rogowski

GRADE 9 AND UP

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The teacher's edition contains solutions with complete listing in Basic, sample run and in-depth analysis explaining the algorithms and theory involved. 280 pp softbound, $9.95 [9Y].

The Impact of Computers on Society and Ethics: A Bibliography

REFERENCE

Gary M. Abshire.

Where is the computer leading us? Is it a menace or a messiah? What are its benefits? What are the risks? What is needed to manage the computer for society's greatest good? Will we become masters or slaves of the evolving computer technology? This bibliography was created to help answer questions like these. It contains 1920 alphabetical entries of books, magazine articles, news items, scholarly papers and other works dealing with the impact of computers on society and ethics. Covers 1948 through 1979. 128 pp hardbound. $17.95. [12E].

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The Best of Creative Computing

The first two years of **Creative Computing** magazine have been edited into two big blockbuster books. **American Vocational Journal** said of Volume 1, "This book is the 'Whole Earth Catalog' of computers." [6A] Volume 2 continues in the same tradition. "Non-technical in approach, its pages are filled with information, articles, games and activities. Fun layout." —**American Libraries.** [6B] Each volume $8.95.

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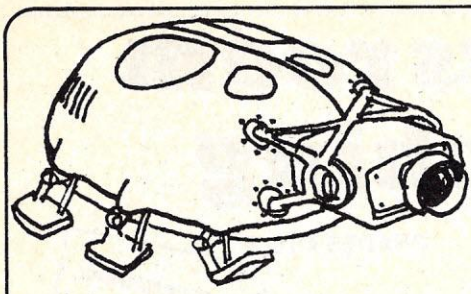

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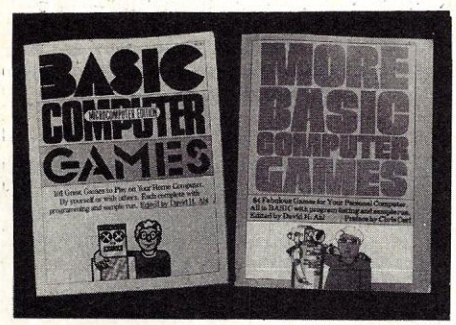

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The Best of Byte

This is a blockbuster of a book containing the majority of material from the first 12 issues of Byte magazine. The 146 pages devoted to hardware are crammed full of how-to articles on everything from TV displays to joysticks to cassette interfaces and computer kits. But hardware without software might as well be a boat anchor, so there are 125 pages of software and applications ranging from on-line debuggers to games to a complete small business accounting system. A section on theory examines the how and why behind the circuits and programs, and "opinion" looks at where this explosive new hobby is heading. 386 pp softbound. $11.95 [6F]

Katie and the Computer

Fred D'Ignazio and Stan Gilliam. This is a delightful story told in words and full color drawings of Katie's adventures when she "falls" into a computer. In Katie's journey through the land of Cybernia she meets the Software Colonel, the Bytes, the Table Manager and even a ferocious Program Bug. Her journey parallels the path of a simple command through he stages of processing in a computer, thus explaining the fundamentals of computer operation to 4-10 year olds. Supplemental explanatory information is contained in the front and back end papers. 42 pp. hardbound $6.95.

Computer Music Record

A recording was made of the First Philadelphia Music Festival which is now available on a 12" LP record. It features eight different computer music synthesizers programmed to play the music of J.S. Bach, J. Pachelbel, Rimsky-Korsakov, Scott Joplin, Neil Diamond, Lennon & McCartney and seven others. The music ranges from baroque to rock, traditional to rag and even includes an historic 1963 computerized singing demonstration by Bell Labs. $6.00 [CR101].

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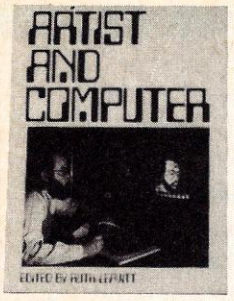

Artist and Computer

This unique book by Ruth Leavitt covers the latest techniques in computer art, animation and sculpture. In its pages 35 artists explain how they use computers as a new means of self-expression. **The San Francisco Review of Books** said "Get yourself a copy of this book if you enjoy feeding your mind a diet of tantalizing high-impact information." Over 160 illustrations, some in full color. 121 pages hardbound [6E] $10.00. Softbound [6D] $4.95.

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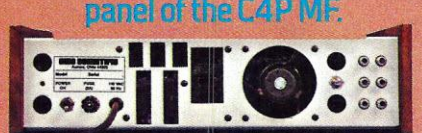

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